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AIMS AND SCOPE OF *INDUSTRY AND DEVELOPMENT*

Industry and Development attempts to provide a link between practitioners and theorists working on economic and related aspects of industrialization. The focus of the journal is on applied economics, particularly in areas emphasized in the Lima Declaration and Plan of Action on Industrial Development and Co-operation.

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Preface

The role of industry and industrial policies in economic development, and particularly in the context of the Lima target,[1] has been extensively analysed in past issues of *Industry and Development* and elsewhere in the literature of industrialization. What distinguishes this issue from the previous ones is its emphasis on modelling approaches to policy analysis in the area of industrial development for the developing countries. More specifically, this issue shows how some of the quantitative models are used to explain certain industrialization processes, to discern the policy implications of certain industrial policies, and to generate projections under a set of varying assumptions. The issue does not dwell upon the technique and methodology of model-building.

Models are representations of particular phenomena or observable systems in the real world. In other words, they are abstractions of a reality that is too complex to represent in full detail and they therefore focus only on the principal relationships that describe and explain the phenomenon, by eliminating inconsequential influences and simplifying the processes. The purposes to which a model is put are policy analysis, projections and forecasting. Nowadays the decisions of policy-makers are to a growing extent being influenced by the calculations and policy implications derived from policy models. It is therefore imperative to have a clear understanding of the limitations and possibilities of policy models, in view of the increasing dependence of policy-makers on the results obtained from them.

Some of the major limitations inherent in policy models can be summarized as follows. First, the art of model-building depends critically on the intuitive judgement of model-builders and on how the complex real world is perceived and abstracted or simplified to manageable proportions. Many serious problems emerge in this process of simplification or idealization. Most obvious of all, the conclusions and policy implications of the model tend to be very much influenced by how model-builders view the real world and reduce it to a set of fundamental relationships. Using the model-builders' jargon, the conclusion reflects the model specification. In other words, the choice of the model-builders themselves can *a priori* dictate the conclusions emanating from the model. In particular, the assumptions used in the formulation of models greatly influence the results obtained. Less obvious is the fact that, since models are simplified or idealized representations and not replicas of the real world, the results obtained from them are necessarily imprecise. As a result, those who use models for policy-making should be fully aware of the possibility that the results may be erroneous. Of course, the degree

[1]The target of increasing the share of the developing countries in world industrial production to 25 per cent by the year 2000 was set in the Lima Declaration and Plan of Action on Industrial Development and Co-operation (ID/CONF.3/31, chap. IV), transmitted to the General Assembly by a note by the Secretary-General (A/10112) and also available as UNIDO public information pamphlet PI/38.

of imprecision is directly related to the extent of the mis-specifications in the model and the extent of the realism of the assumptions on which it is based.

Most troublesome to model-builders is the treatment of political factors. Because of their extreme unpredictability, many model-builders exclude political variables. Yet it is often the political factors that dominate the economic processes. Unfortunately, the current state of the art in model-building is not yet up to the challenge of translating the behaviour of political actors into mathematical equations.

Although these limitations may suggest that the models should be viewed with some scepticism, their usefulness should not be totally overlooked. The only alternative to the modelling approach is some sort of economic analysis, based on the same inadequate data encountered in model-building, some implicit theoretical underpinning and a set of assumptions. This means that the non-modelling approach cannot evade the same basic criticism as that levelled at the modelling approach; more importantly, it often fails to indicate clearly the quantitative impact of policy changes, which is undoubtedly the forte of policy models.

Once it has been ascertained that the assumptions underlying the models are realistic, that the results are not sensitive to parameter changes (in other words, that they remain plausible even when some key parameters change), and that the models are capable of depicting the situation with reasonable accuracy, they can then become an extremely useful tool for policy-making and planning. They provide a framework within which policy-makers can make consistent and rational decisions. They can provide quantitative implications of policy changes and can hence facilitate an evaluation of the consequences of pursuing various policy options. Needless to say, however, the results of these policy models should be complemented by in-depth qualitative analyses based on the policy-maker's own knowledge of the problem, which often includes elements not explicitly accounted for by the model.

In practice, there is a wide range of quantitative models from which to choose for policy analysis. The best known among them are input-output models and econometric models. An econometric model is a system of related equations describing a set of relations that determine the characteristics of the observed data. The builders of such models seek to estimate quantitative interrelations among variables and measure the impact of one variable on another in order to be able to predict future events or explain some economic process. On the other hand, the basis of the input-output analysis is the input-output table. This table shows how the output of each industry is distributed among other industries and sectors of the economy. At the same time it shows the inputs to each industry from other industries and sectors. The salient feature of the input-output model is the delineation of interindustry linkages, for which an econometric model may prove to be less suited.

The input-output analysis is today widely used as an analytical tool in highly developed economies and to a lesser extent in developing countries for economic planning, resource allocation, income distribution and analysis of other important policy issues. In this issue, two articles dealing with the Lima target use the input-output model, the article on investment planning in the Syrian Arab Republic uses an econometric model and the UNITAD article employs both input-output and econometric techniques for policy analysis.

One of the input-output models that have been developed by UNIDO to seek the policy implications of the Lima target is the Lima Development Objective (LIDO) model. Using this LIDO model, the first article, entitled "Modelling the attainment of the Lima target: the LIDO model", attempts to delineate alternative paths up to the year 2000 that will lead to the achievement of the Lima target (in terms of the developing regions' shares of the world manufacturing output) under different scenarios of the world economy. Two scenarios of economic development up to the year 2000 are postulated. The first, known as a "reference scenario", incorporates the hypothesized future world economic conditions as they were seen in the mid-1970s, and the second incorporates major elements of the International Development Strategy for the Third United Nations Development Decade. Then, with the aid of the LIDO model, the study calculates and compares the growth rates of the gross domestic products of the developing countries required to reach the Lima target, and analyses the consequent policy implications related to external resource flows, investment requirements, balance of payments etc.

In the second article entitled "Industrial carrying capacity and the Lima target", the analytical scope of the first study is extended to investigate the capacity of the earth's resources to sustain the industrialization implied by the Lima target. More specifically, using the scenario for the Third Development Decade of the LIDO model, the paper assesses the availability of three major resources—labour, natural resources and energy—and the extent to which supply can meet the demand implied by the achievement of the Lima target in the year 2000. The study concludes on the encouraging note that no serious constraints, economic or physical, appear to emerge to frustrate the global economic development envisaged under the LIDO scenario.

In the third article, "The UNITAD project: a world model to explore institutional changes over the long run", a further methodological extension is made to couple a global input-output system with a set of econometric equations. At the core of the UNITAD model are 11 input-output regional matrices (five for the developed and six for the developing regions), interlinked through seven trade matrices, each of which corresponds to a well-defined product group, while a set of econometric equations is used to estimate key structural coefficients of the model, such as technology, productivity, savings and consumption, imports and exports etc. The UNITAD system can be characterized as a world and economy-wide simulation model used to assess the effects of changes in international and domestic policies on a number of critical variables, including current-account positions, the level of unemployment, the rate of growth of income and consumption *per capita* etc. The system pays particular attention to the problems of international trade and finance and industrialization. One of the innovative features of the model is that it allows the simulation of "traditional" development policies (more growth in the North, more North-South trade, more official development assistance, more market lending) as well as of "less traditional" policies (for example, a gradual delinking of North-South, economic co-operation among developing countries, domestic institutional changes, and the choice of more appropriate technology).

Finally, descending from a majestic view of the global modelling to a close-up of a more down-to-earth country landscape, the article on investment planning and industrialization in the Syrian Arab Republic shows how an

integrated two-tier system consisting of a macro-econometric model and a detailed industry econometric model was used to generate consistent projections of the structure of output in the manufacturing sector of the Syrian economy. The rationale for having a two-tier system is that, in order to model the industrialization process for development, the entire economy has to be modelled, since the interrelations between the industrial sector and the other sectors of the economy are such that any study of the industrial sector in isolation is unjustifiable. Special efforts were made to reflect in the model a number of distinguishing features that are unique to the Syrian economy. The model was used to carry out several impact simulations in order to assess the macro-economic and industrial effects of alternative public investment decisions.

EXPLANATORY NOTES

References to dollars ($) are to United States dollars, unless otherwise stated.

References to tons are to metric tons.

A slash between dates (e.g. 1970/71) indicates a financial or academic year.

A hyphen between dates (e.g. 1960-1964) indicates the full period involved, including the beginning and end years.

In tables:

Three dots (. . .) indicate that data are not available or are not separately reported.

A dash (—) indicates that the amount is nil or negligible.

A blank indicates that the item is not applicable.

Columns do not necessarily add to the totals, because of rounding.

The following abbreviations have been used:

ACC	Administrative Committee on Co-ordination
ECE	Economic Commission for Europe
ECWA	Economic Commission for Western Asia
FAO	Food and Agriculture Organization of the United Nations
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GNP	gross national product
ICOR	incremental capital output ratio
ILO	International Labour Organisation
MVA	manufacturing value added
NMP	net material product
ODA	official development assistance
OLS	ordinary least squares
RMSE	root mean square errors
UNCTAD	United Nations Conference on Trade and Development

Modelling the attainment of the Lima target: the LIDO model

Secretariat of UNIDO

Introduction

One of the models developed by UNIDO to aid the analysis of the Lima target is the Lima Development Objective (LIDO) model. Its purpose is to formulate, for the period up to the year 2000, scenarios reflecting the achievement of the Lima target (in terms of the share of the developing regions in the world's manufacturing output) on the basis of different hypotheses regarding the future state of the world economy.

A description of the LIDO model

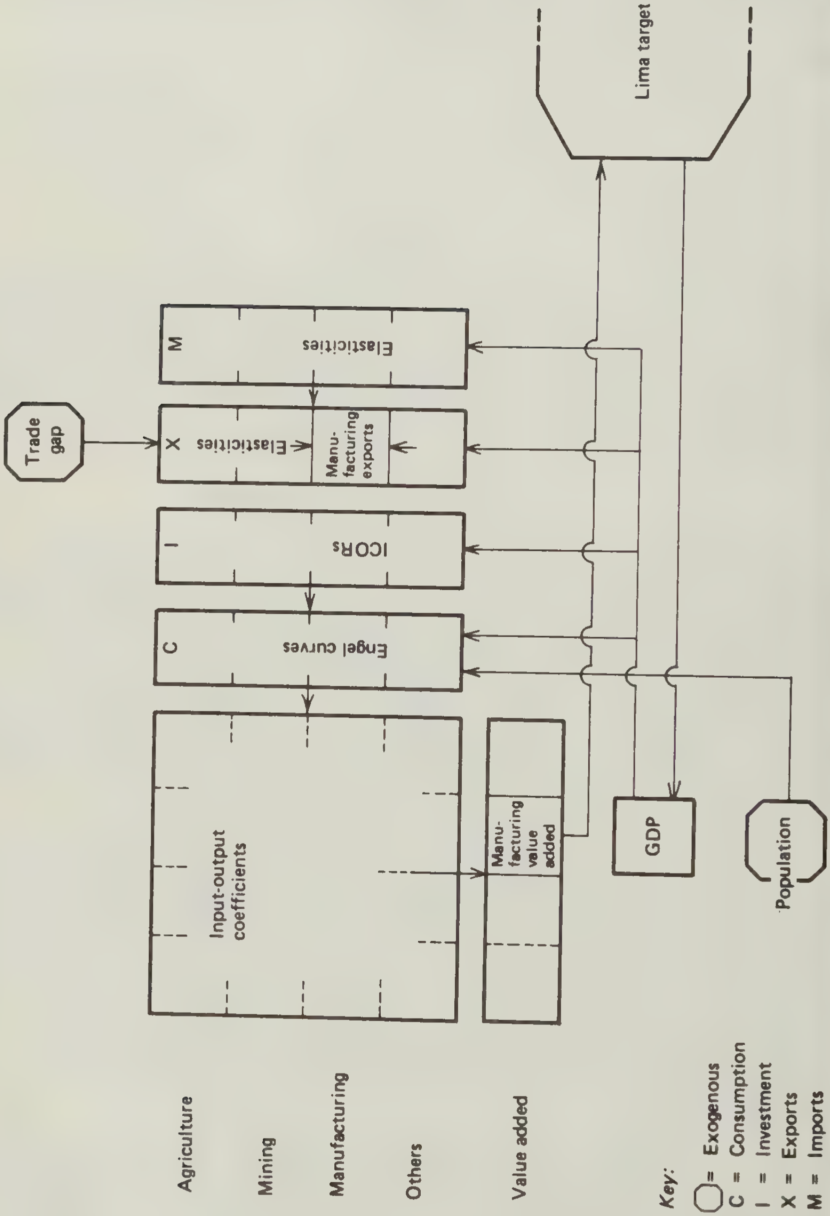
In its present form, LIDO distinguishes four regions and one economic grouping (Africa, Asia, Latin America, the Middle East and the industrialized countries), for each of which economic input-output accounts are kept. The detail given in the input-output accounting divides the economy into four sectors: agriculture, mining, manufacturing, and "others".

In its original formulation, LIDO was a single-period model, designed to produce a solution for the year 2000, the year of the Lima target. It has since been converted to a multi-period model (generating solutions for 1980 and 1990, as well as 2000) to accommodate the strategy for the Third United Nations Development Decade.

Essentially the LIDO model is a mechanism for completing a scenario rather than for generating a solution, in that it attempts to fill in the remainder of an economic configuration partially supplied for the target year. The first step in the operation of the system is to supply the estimated average growth rates of the gross domestic product (GDP) for each region, the value for the growth rate in the industrialized countries having already been stipulated exogenously. The rates for the other regions are modified as necessary by the model, the estimates being supplied only to initiate the solution process. These growth rates are then used to derive GDP totals for each region for the target year (see figure I).

Final demand is examined under four headings: consumption (C); investment (I); exports (X); and imports (M). For each region, each of these components is considered as a vector distinguishing agriculture, mining, manufacturing and "others". The sum of consumption, investment and exports, less imports, gives the GDP. The GDP value for each region thus acts as a control in the final demand estimation, which is carried out by estimating the separate component vectors.

Figure I. A regional component of the LIDO model



Imports

Imports are the first vector to be calculated. Each of the elements—agricultural, mining, manufacturing and other imports—are calculated using elasticities with respect to the growth of GDP.

Exports

The model system requires that the trade deficit should be specified in advance. This permits an examination of alternative scenarios in which, for instance, the industrialized countries can be assumed to finance a trade deficit for the developing regions. The distribution of this deficit among the developing regions is flexible. In addition to an over-all deficit for the developing regions (for example, 1 per cent of the GDP of the industrialized countries), it is also possible to incorporate specific assumptions about the balance of trade for individual sectors. Thus, a particular constraint could be applied to agriculture, specifying, for example, that the exports and imports for each region are equal, in this way incorporating agricultural self-sufficiency into the scenario. This has been done in the reference scenario, but because it generated growth rates of the agricultural sector that in some cases were felt to be too high, it was altered in the scenario for the Third United Nations Development Decade (see the following section).

With the assumption of self-sufficiency in agriculture in each region, since the agricultural imports have been already calculated, the agricultural exports are also known. The mining and "other" elements of the export vector are then estimated, using elasticities with respect to GDP. The total for exports is, of course, itself derived from the previously calculated total imports and the exogenously supplied figures for the trade gap. This means that, from the values for total exports and for three elements of the export vector, one can derive the fourth element, manufacturing exports, as a residual. Thus the manufacturing exports for a region can be viewed as an implication of the over-all assumptions of the model.

Investment

The investment column considered here refers only to gross fixed capital formation, since changes in inventories are not considered. Given the four sector classifications into which it is divided, each of the elements of the vector has a fairly precise significance. The agriculture element is very small in the developing regions, and zero in the industrialized countries. The mining element is zero. "Manufacturing" can be taken to reflect the manufacture of capital goods and "others" can be taken to mean construction. Observed proportions within the column are maintained, that is to say, the different sectors deliver fixed shares of total investment. The model allows for the determination of the investment share of GDP in several ways, using, for example, gross or net incremental capital-output ratios (ICORs) in the aggregate or at the sectoral level; in the scenarios presented later, a gross ICOR for each region is assumed, according to the level of GDP *per capita* that has been attained.

Consumption

The total for the consumption column is derived as a residual: C = GDP + M − X − I. Thus, the policy aspects of investment, namely, that consumption must be correspondingly forgone, are brought sharply into focus. From this total, the individual components of the consumption vector are found through the use of Engel curves to determine the share in total consumption of each of the sectoral outputs, according to the changes in *per capita* GDP.

Input-output coefficients

Input-output accounting has been adopted in this model in order to ensure consistency in the sectoral projections. The inter-industry approach takes into consideration the links between the different sectors and the degree to which they depend upon one another, so that, for instance, the production level of the "others" sector associated with a particular level for manufacturing can be determined. These links, expressed as technical coefficients, cannot, however, be regarded as constant, since they change over time in response to manufactures. It is clear that input-output coefficients derived from historical data for 1975 cannot be expected to remain applicable in 2000, and even the derivation of these historical data raises problems, particularly for the developing regions. Nevertheless, initial estimates of regional input-output coefficient tables have been formed from representative data for each of the five regions and are used as base-year reference tables.[1] The underlying assumption in the scenarios to be described is that the production structure of the developing regions will tend towards the present structure of the industrialized countries as the level of development of these regions approaches the present level of the industrialized countries. For the industrialized region itself, the assumption is of a time-trend in the value-added component with the maintenance of constant proportions among the intermediate input coefficients.

The technical coefficients for the developing regions are estimated as follows: given the GDP of a region, its GDP *per capita* is calculated using the population projections exogenously supplied. Thus, GDP *per capita* serves once more as an indication of development, and is used to determine the positions for each technical coefficient and the value-added coefficient on the path from its starting point to the target.

Feedback adjustment

The Leontief inverse matrices are then formed from the technical coefficient matrices for each region, and the means thus exist to carry out the standard input-output analysis, in which the final demand vector is multiplied

[1]This was a pilot study for the much more thorough estimation procedure for regional input-output coefficients used in the UNITAD model project. See, for example, "The analysis and long-term projection of interindustry structures. Construction of base-year matrices for the regions of the UNITAD project" (UNIDO/ICIS.163).

by the $(I - A)^{-1}$ matrix in order to derive the corresponding total output levels ıssociated with this pattern of final demand.

The value-added coefficients, together with the new total output levels, rield the absolute figure for value added in each sector in each region. (The otal of value added for each region will be the GDP.) Particular interest ıttaches to the manufacturing value-added (MVA) figures, for it is in these erms that the Lima target and its regional components are defined.

Since it was the initial GDP estimates that led the model to produce these irst estimates of value added, the model now makes an appropriate adjustment o these estimates, scaling them up or down according to whether the region's Lima target has been exceeded or undershot. (The GDP of the industrialized countries is not altered: their MVA therefore determines the absolute levels of MVA that the other regions have to achieve.)

As a consequence of the GDP revision for the developing regions, the whole calculation begins once more, since the new GDP estimate will in turn rield new final demand components, new input-output coefficients and so on. The cycle continues until the Lima targets are achieved for each region. The esult is the final estimate for the Lima target scenario, with fully consistent ralues for all the variables.

It may be seen that the LIDO model is somewhat different in its approach o other economic models, in that it attempts to reconcile forecasts (such as GDP *per capita*), targets (such as the regional components of the Lima target) ınd economic relationships (including changes in these relative levels of levelopment). Moreover, almost the entire burden of this reconciliation is hrown upon the computational algorithm pursued by the model.

Two scenarios for the Lima target

In this section two scenarios of economic development up to the year 2000 ıre discussed, the reference scenario, incorporating hypothesized future world economic conditions as they were seen in the mid-1970s, and a scenario ncorporating the targets of the Third United Nations Development Decade. In ooth cases the basic assumptions are discussed first and then the technical letails of the model calculations.

Reference scenario

Key assumptions

In the LIDO model there are three exogenous assumptions regarding the ralues of economic variables for the target year that are fundamental to the levelopment of the reference scenario.

First, the growth rate of GDP in the developed countries is taken as an ıverage of 4 per cent per annum between 1975, the base year of the calculations, and 2000. This value was chosen because it reflected informed opinion at the time of the development of the model, particularly within the Economic Commission for Europe, on the rates likely to be achievable. (In the

light of the general downward revision in estimates of future economic growth in the developed countries since the development stage of the LIDO model, in the scenario for the Third United Nations Development Decade this growth rate has been lowered so as to range between 3.5 per cent and 3.9 per cent.)

Secondly, the Lima target for regional shares in total world manufacturing value added is assumed to have been achieved by the year 2000. That is, it is built into the scenario that the share of each developing region's manufacturing value added in the world total should be a given percentage, the distribution of the developing countries' total 25 per cent having been determined as in figure II (the 1975 values are given for purposes of comparison).

It should be pointed out that there is in fact a contradiction between the shares for developing regions shown in figure II and those agreed on at regional conferences held prior to the Second General Conference of UNIDO at which the Lima target was adopted. The target share agreed on for the ESCAP region of 10 per cent[2] did not include the Middle East. The share agreed on for Latin America was 13.5 per cent.[3] It can be seen that, with a 2 per cent share for Africa, this gives a total of 25.5, excluding the Middle East. In the absence of an accepted reconciliation of these targets, the present working disaggregation of the goal has been used. The structure of the LIDO model is such that alternative regional distributions of the 25 per cent total may be readily examined.

Thirdly, trade balances are supplied exogenously: the over-all trade surplus of the industrialized countries for the year 2000 is given as $134 billion in 1975 prices. This is balanced by deficits in Africa, Asia and Latin America of $44.8 billion each, while for the Middle East a zero balance was postulated. These figures were not arbitrarily chosen, however, because the surplus of the industrialized countries represents a 1 per cent share of its total GDP in the year 2000 (given the assumed 4 per cent annual average growth rate in this region). It can thus be seen as aid for deficit financing, and is divided equally between the non-oil-producing regions. (It will be recalled that the targets set for the Third United Nations Development Decade included one of 0.7 per cent of the developed world's gross national product (GNP) as concessionary aid flows to the developing countries.[4])

Calculating the reference scenario

Having outlined these assumptions, the results of the scenario may be summarized, so that the contrasts between the different regions and between the present situation and the postulated future will be readily apparent.

Table 1 shows the structural composition of final demand (in billions of 1975 dollars) in each region in terms of its major components. If the variables

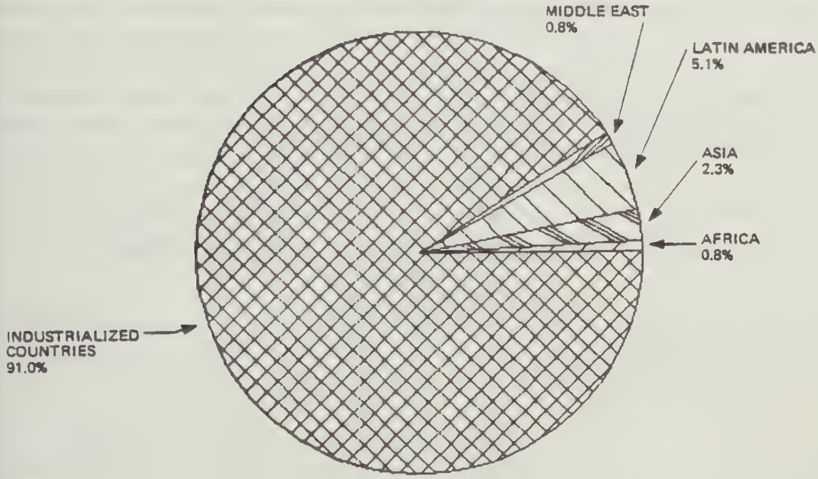
[2]Decision taken at the Meeting of Ministers of Industry of Developing Countries in Asia and the Pacific Region, held at Bangkok on 30 October 1974.

[3]Decision taken at the Latin American Conference on Industrialization, held at Mexico from 25 to 29 November 1974.

[4]See paragraph 24 of the International Development Strategy for the Third United Nations Development Decade (General Assembly resolution 35/56, annex).

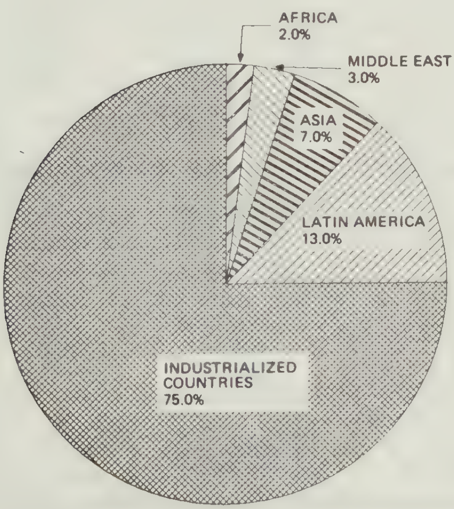
Figure II. Regional shares in manufacturing value added for the world as a whole

A. Actual shares, 1975[a]



[a]Estimates using the best information available at the time the scenario was run.

B. Lima targets, 2000



were to grow at a constant annual rate between 1975 and 2000 to reach the scenario values shown in table 1, then the rates given in table 2 would be the ones to be adopted.

The growth rates of GDP show the over-all progress implied for each of the economies, the rate for the industrialized countries being, of course, exogenously given. It is therefore clear that the growth rates in the developing regions must exceed the figure for the developed countries by between approximately 3.2 and 4.5 percentage points if the targets for the year 2000 are to be met.

A picture of the changes in the structure of final demand is given in table 3, which shows the percentage share of each component in total GDP in 1975 and 2000, for the industrialized countries and for the developing countries as a whole.

Table 1. Final demand: values for the year 2000

(Billions of 1975 dollars)

Region/economic grouping	*GDP*	*Consumption*	*Investment*	*Exports*	*Imports*
Africa	635.75	533.43	147.09	175.58	220.36
Asia	1 715.03	1 306.89	452.93	397.05	441.84
Latin America	2 831.63	1 787.92	1 088.49	486.93	531.72
Middle East	985.48	657.99	327.47	422.35	422.34
Industrialized countries	13 445.94	10 245.91	3 065.67	2 726.1	2 591.75

Table 2. Final demand: average annual growth rates, 1975-2000

(Percentage)

Region/economic grouping	*GDP*	*Consumption*	*Investment*	*Exports*	*Imports*
Africa	7.2	7.3	6.8	7.2	7.1
Asia	8.3	7.9	9.2	9.4	8.9
Latin America	8.5	7.6	10.8	9.6	9.2
Middle East	7.4	8.3	8.5	6.2	8.1
Industrialized countries	4.0	4.0	3.9	4.9	4.6

Table 3. Final demand: components' share of GDP, 1975 and 2000

(Percentage)

Economic grouping	*Consumption*	*Investment*	*Exports*	*Imports*
1975				
Developing countries	76.0	23.4	24.6	24.0
Industrialized countries	76.9	23.2	16.4	16.5
2000				
Developing countries	69.5	32.7	24.0	26.3
Industrialized countries	76.2	22.8	20.3	19.3

Thus it can be seen that the large increase in the investment share for the developing region has a pronounced (negative) effect on the consumption share and also requires an increase in the import share.

Turning to the supply side, the implications for the value added in each sector may now be examined. It is already known that MVA, which is used in the definition of the Lima target, will meet the supplied criterion for regional shares. The absolute values and the implied growth rates of all four sectors are given in tables 4 and 5 respectively.

It follows from the earlier model description that the causes of the production levels in each sector (and thus of valued added in each sector) are such that the sectoral value-added growth rates will change in relation to one another according to the over-all GDP growth rate for the region. Since, however, the Lima targets call for a specific shift in the regional shares of world manufacturing value added, and given the growth rate of manufacturing in the developed region, it is always possible to calculate the required corresponding rate for any of the other regions. This can be done quite independently of any model, since the relationship is straightforward. It will be seen that in the present case, the gap—that is, the amount by which the growth rate of MVA in a developing region must exceed that of the industrialized countries—varies between 4.8 (for Africa and Latin America) and 6.4 (for the Middle East). The growth rates of MVA are in all cases—even in the industrialized countries—greater than the growth rates of GDP as a whole.

Just as the effects of the different growth rates of final demand components caused changes in these components as a percentage of GDP, so do the varying value-added rates alter the relative sectoral composition of

Table 4. Value added, by sector, for the year 2000

(Billions of 1975 dollars)

Region /economic grouping	*GDP*	*Agriculture*	*Mining*	*Manufacturing*	*Others*
Africa	635.75	119.6	47.2	120.0	348.9
Asia	1 715.03	321.4	39.8	419.7	934.2
Latin America	2 831.63	190.4	134.9	779.4	1 726.9
Middle East	985.48	49.7	219.7	179.9	536.1
Industrialized countries	13 445.94	574.4	257.2	4 496.0	8 118.3

Table 5. Value added: average annual growth rates, 1975-2000

(Percentage)

Region /economic grouping	*GDP*	*Agriculture*	*Mining*	*Manufacturing*	*Others*
Africa	7.2	5.0	5.8	9.4	8.0
Asia	8.3	5.7	6.4	10.4	8.9
Latin America	8.5	6.0	8.5	9.4	8.6
Middle East	7.4	6.1	4.3	11.0	8.8
Industrialized countries	4.0	2.0	2.3	4.6	3.9

GDP. Table 6 shows the shares for each of the sectors in 1975 and 2000, and thus highlights the shifts that are to take place.

The structural shifts implied by the scenario are quite extensive. Agriculture's share of total GDP decreases very sharply for Africa, Asia and Latin America. For the manufacturing sector, the share will increase, but by no means to the same degree for all regions: in the Middle East it will more than double, in Africa and Asia it will increase by something over one half and in Latin America it will only increase by just over one fifth. For the Middle East, the share of GDP generated in mining is seen to decrease significantly, in contrast to the other regions, where the changes in this share are not dramatic. These large shifts in the composition of value added in the Middle East can be taken to be the result of a large investment of oil revenues in industrialization and the running down of oil reserves.

The shifts in the regional shares of MVA have already been discussed, but in summarizing the changes in the structure of the world economy as a whole it is also possible to look at the regional shares in world GDP and world exports, and this is done in table 7.

Several conclusions emerge. First of all, the attainment of the Lima target shares for manufacturing output means that a much greater increase is required

Table 6. Sectoral shares in total value added (GDP), 1975 and 2000

(Percentage)

Region /economic grouping	*Agriculture*	*Mining*	*Manufacturing*	*Others*
1975				
Africa	31.8	10.5	11.4	46.3
Asia	34.3	3.6	15.7	46.4
Latin America	12.3	4.7	22.4	60.7
Middle East	6.8	46.1	7.9	39.2
Industrialized countries	6.7	2.1	29.1	61.3
2000				
Africa	18.8	7.4	18.9	54.9
Asia	18.7	2.3	24.5	54.5
Latin America	6.7	4.8	27.5	61.0
Middle East	5.0	22.3	18.3	54.4
Industrialized countries	4.3	1.9	33.4	60.4

Table 7. Regional shares of world GDP and exports

(Percentage)

Region /economic grouping	*GDP*		*Exports*	
	1975	*2000*	*1975*	*2000*
Africa	1.9	3.2	2.9	4.2
Asia	4.0	8.7	4.0	9.4
Latin America	6.2	14.4	4.8	11.6
Middle East	2.8	5.0	9.0	10.0
Industrialized countries	85.2	68.6	79.3	64.8

n the share of GDP. Thus, for example, Africa's MVA in 2000 is 2 per cent but ts GDP share is 3.2. Over-all, the developing region's total of 25 per cent of world MVA is accompanied by a 31.4 per cent share of world GDP. The shares of world exports show even greater changes, the developing region's share in world exports having increased from 20.7 per cent to 35.2 per cent.

Scenario for the Third United Nations Development Decade

Key assumptions and the Third United Nations Development Decade[5]

As already mentioned, the structure of the LIDO model was altered for the preparation of the scenario for the Third United Nations Development Decade. In particular it was changed from a single-period to a multi-period model, giving results for the intermediate years 1980 and 1990. This was both to provide a specific analysis of the period covered by the Decade and to study contrasting assumptions. In addition, an extra constraint was imposed on the model, which caused it to adhere to a predetermined growth rate for agriculture n the developing countries, which, based on FAO assumptions, was set at 3.6 per cent per annum in value-added terms.

The generally lower levels of economic performance in the mid and latter 1970s in both the developing and the developed countries as compared with the previous period, combined with the general downward revision of expectations for economic growth in the medium term that followed, led to a revision in the basic assumption in the LIDO model regarding the growth of GDP in the developed countries. Thus, in the scenario for the Third United Nations Development Decade, the rate for 1975-1980 was set at the average of the period 1972-1977 (that is, 3.5 per cent); a growth rate of GDP of 3.7 per cent was assumed for the developed countries during the Decade (1980-1990); and for the period 1990-2000 the GDP growth rate was assumed to average 3.9 per cent.

At the same time, advantage was taken of the possibility of introducing growth rates for the developing countries based on recent data and projections. Thus, whereas the growth rate of total value added in the developing countries had previously been totally endogenous, the growth rate for the period 1975-1980 was now based on the average for the period 1972-1977 (that is, 6.2 per cent) and the rate for the period 1980-1990 was set at 7.4 per cent per annum—the figure used both by the Food and Agriculture Organization of the United Nations (FAO)[6] and by the Department for International and Economic Affairs of the United Nations Secretariat. For the period 1990-2000, the growth rate is calculated, as before, by the model; it is the rate that is necessary in order to allow the Lima target to be obtained by the year 2000.

Table 8 shows the two sets of growth rates (exogenous growth rates n italics). For the periods 1975-1980 and 1980-1990, it is clear not only that

[5]Owing to revisions in the assumptions made on the behaviour of technological coefficients in the developing regions, the data presented in this paper differ slightly from those used in previous UNIDO position papers.

[6]See "Agriculture: towards 2000", technical working paper prepared by FAO for the Preparatory Committee for the New International Development Strategy.

Table 8. Key assumptions in the original and modified LIDO scenarios

Item	*Original scenario 1975-2000*	*Modified scenario*			
		1975-1980	*1980-1990*	*1990-2000*	*1975-2000*
GDP (average annual growth rate)					
Developed countries	*4.0*	*3.5*	*3.7*	*3.9*	
Developing countries	8.1	*6.2*	*7.4*	8.4	
Average annual agricultural growth rate of developing countries	5.6				*3.6*
Agricultural trade surplus in developed countries (billions of dollars)	*0*				689
Gross ICORs (units)					
Asia, Africa	*3.2*				*3.2*
Latin America, Middle East	*4.5*				*3.6*

Note: The figures in italics are given exogenously in the LIDO model.

the growth rates for both groups of countries are now lower but that the gap between the growth rates has been reduced. For the period 1990-2000, the growth rate for the developed countries is still lower than in the original scenario, but in order to meet the Lima target for the share of manufacturing output, the growth rate of the developing countries will have to increase to a level well over double that of the developed countries.

The opportunity was also taken to modify the previous assumption regarding agricultural production in the developing countries (namely, that each region was self-sufficient) in the light of a study by FAO that suggested that it would be difficult for some of the developing regions to attain a rate higher than 3.6 per cent per year.[7] Since the previous assumption had generated a higher rate of growth of agricultural value added in the developing countries (5.6 per cent), the effect of limiting growth in agriculture in the developing countries was to create an agricultural trade surplus in the developed countries of $689 billion, where there had previously been an (assumed) balance (see table 8).

A third modification was to lower the ICORs assumed for Latin America and the Middle East from the original value of 4.5 to 3.6. This is important in the solution process of the LIDO model, since an assumed gross ICOR for each region is used to determine the share of investment in GDP. The result of introducing increased efficiency in the utilization of investment funds in the two regions is that the share of the developing countries in total world investment required to meet the Lima target is lower at all points in the modified scenario than in the original. (For 1990, for example, the result of the lower growth rates is that the required investment share is fully one fifth lower—25.5 per cent in the modified scenario as against 32.5 per cent in the original scenario.)

It therefore follows that, given the constant assumption in both scenarios regarding financing from the developed countries that is made available to the developing countries, the required savings ratio in the developing countries will

[7] *Ibid.*

so fall: for the year 2000 the required savings ratio in the modified scenario is .9 per cent as opposed to 30.3 per cent in the original scenario.

The most important point that emerges from the assumptions for the enario for the Third United Nations Development Decade is that they are asically identical with those that have emerged in the International Development Strategy for the Decade. Thus the scenario of the LIDO model emonstrates some of the implications and requirements of the Decade that can e considered to represent a step towards the achievement of the Lima target.

Results of the scenario for the Third United Nations Development Decade

The level of value added attained by 2000 and the average annual growth ate of value added over the period 1975-2000 in the scenario for the Third nited Nations Development Decade are shown in figure III and table 9, spectively. Because the scenario assumes lower GDP growth rates for both e developing and the industrialized countries, the absolute value of GDP nd of value added created in the individual sectors in 2000, as well as the orresponding average annual growth rate over the period 1975-2000, can be en to be generally lower than in the reference scenario. The major exception the size and growth rate of the agricultural sector in the industrialized ountries, where the lower growth rates assumed for the developing countries ee table 8) lead to an increase of from 2.0 to 2.8 per cent per annum in the owth rate of agriculture in the industrialized countries.

Figure III. Value added, by sector, for 2000

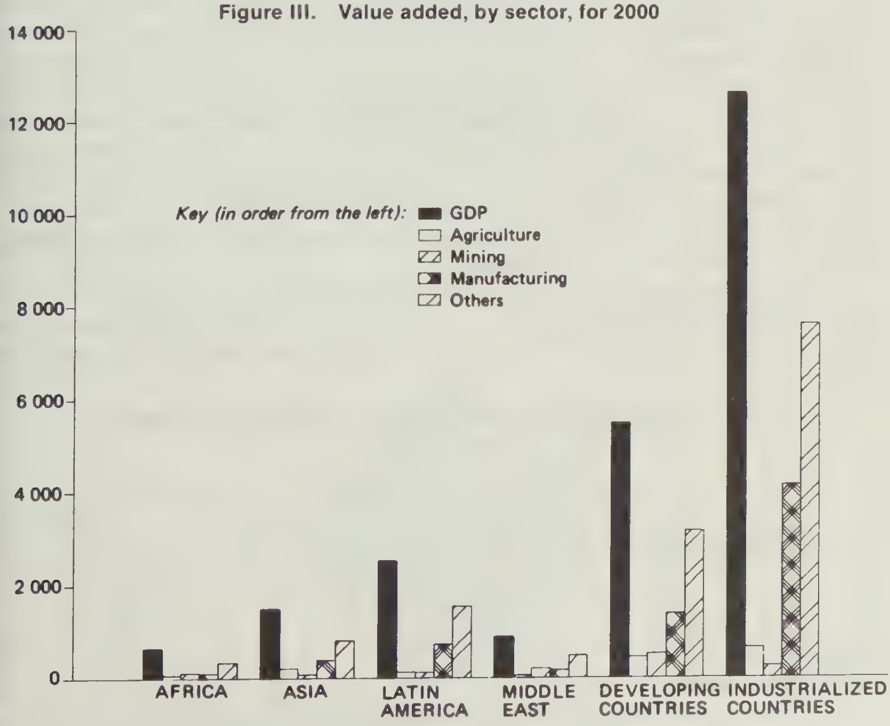


Table 9. Value added: average annual growth rates, 1975-2000

(Percentage)

Region/economic grouping	*GDP*	*Agriculture*	*Mining*	*Manufacturing*	*Othe*
Africa	6.2	2.6	6.0	8.5	7.1
Asia	7.5	3.7	7.4	9.4	8.4
Latin America	8.0	4.5	6.5	8.4	8.5
Middle East	6.6	2.4	3.8	9.4	8.4
Developing countries	7.4	3.6	5.2	8.8	8.3
Industrialized countries	3.7	2.8	0.1	4.2	3.8

Looking at manufacturing in the two scenarios, the reduction in th projected growth rate of GDP in the industrialized countries led to a fall in th average annual growth rate of MVA over the period 1975-2000, from 4.6 pe cent to 4.2 per cent. Mirroring the lower growth rate of GDP in the developin countries for the period up to 1990 and the higher growth rate for the perio between 1990 and 2000, the average annual growth rate of MVA in th developing countries, which averaged 9.8 per cent per annum for the perio 1975-2000 in the reference scenario, fell over the period 1980-1990 (to a average annual rate of 8.7 per cent), and then rose over the period 1990-200 (to 10.2 per cent) in the scenario for the Third United Nations Developmen Decade.

Looking at all four components of value added by the year 2000 in the tw scenarios (see table 6 and figure IV), the major difference is the lower share fo agriculture resulting from the new constraint on the average annual growth rat of agricultural output in the developing countries: from 11.0 per cent of th total value added in the developing countries in the original scenario it fell t 8.1 per cent in the modified scenario. The share of mining and manufacturin then rose correspondingly to make up the reduction in the agricultural sphere The share of mining in the year 2000 in the developing countries thus rose fron 7.2 per cent to 9.3 per cent and that of manufacturing from 24.3 per cent t 25.2 per cent (while that of the "others" sector—which includes constructio and services—stayed at 57.5 per cent).

Table 10 summarizes the effects of the attainment of the Lima target o the structure of the world economy as a whole. As in the reference scenario (se table 7), the increase in the share of GDP necessary to achieve the Lima targe

Table 10. Regional shares of world GDP and exports

(Percentage)

Region/economic grouping	*GDP*		*Exports*	
	1975	*2000*	*1975*	*200*
Africa	2.4	3.5	4.1	5.
Asia	4.1	8.1	4.8	11.
Latin America	6.1	13.3	4.9	13.
Middle East	3.0	4.8	8.5	7.
Industrialized countries	84.5	69.7	77.7	63.

Figure IV. Sectoral percentage share in total value added for 2000

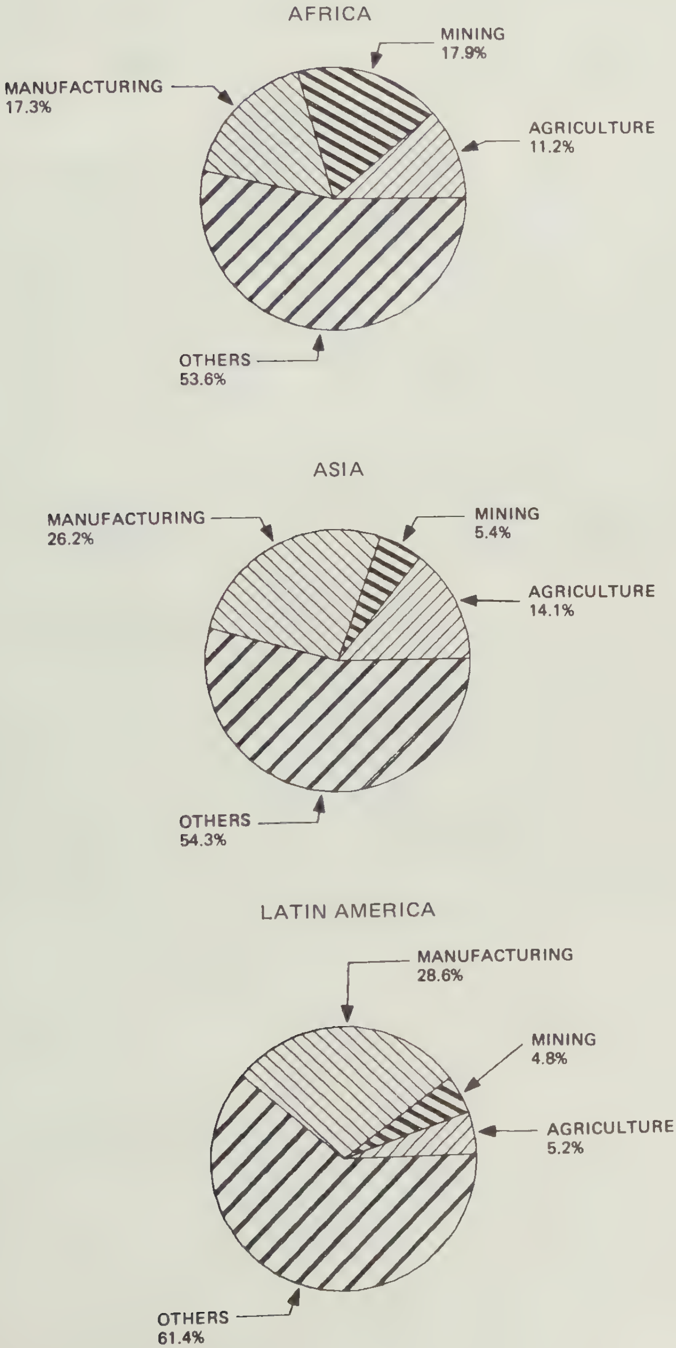
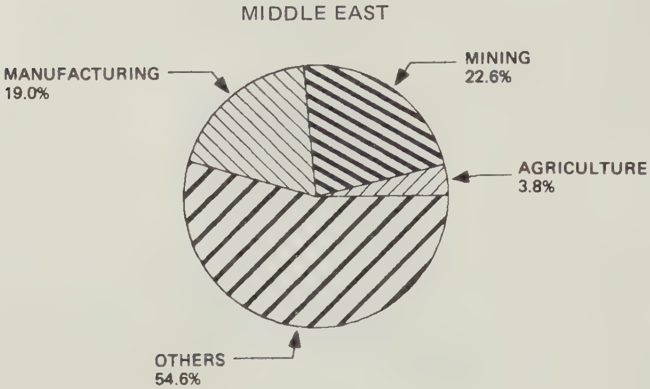
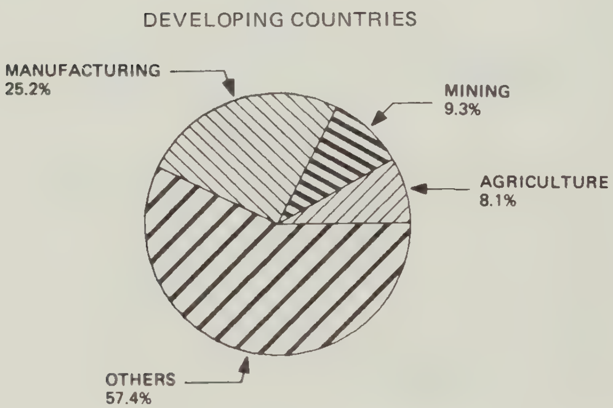
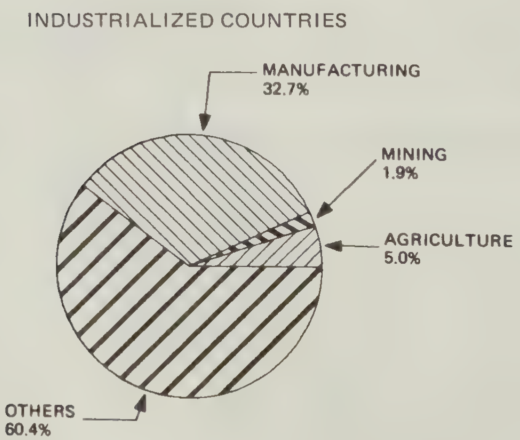


Figure IV. Sectoral percentage share in total value added for 2000 *(continued)*







greater than the increase in the share of MVA: for example, the share of the eveloping countries in GDP rose to 30.3 per cent, while their share in MVA nly rose to 25 per cent. Foreign trade can be seen to have responded even ore sharply, the relative share of the developing countries having risen by two irds (to 36.7 per cent).

Conclusions

The major effect of moving from the reference scenario to the scenario for e Third United Nations Development Decade is to reallocate intertemporally e burden of achieving the Lima target to another period and to make the size the task facing the developing countries in the last decade of the twentieth ntury even larger—the scenario for the Third Decade shows that the GDP of e developing countries as a whole must grow at an annual rate of 8.4 per cent ver the 1990s in order to reach the Lima target. Such growth targets for the eveloping countries are necessarily associated with a transformation of their onomies, as well as an extensive restructuring of the world economy as a hole. Since the scenario for the Third Decade also contains growth rates for e developed countries for the 1980s and 1990s of 3.7 per cent and 3.9 per cent spectively, this suggests that, at a minimum, the North is in a position to help e developing countries to achieve the targeted economic growth rates through reduction in the tariff and non-tariff barriers to trade prevailing in the dustrialized countries.

Even with the assumption of increased capital productivity in the eveloping countries in the scenario for the Third Decade, and even with a oderate reduction in protectionism in the developed countries, the need of the eveloping countries for increased international financial assistance to achieve e Lima target appears even greater than before. In order to attain the Lima rget, the share of the developing countries in world investment should crease to over 30 per cent by 1990 and to almost 40 per cent by 2000. This in rn will only be possible if the level of domestic saving in the developing ountries is supplemented by investment resources from elsewhere, highlighting e need for a substantial increase in the flow of resources in real terms to the eveloping countries on a predictable, continuous and increasingly assured isis.

ndustrial carrying capacity and the Lima target

Secretariat of UNIDO

Introduction

In the present article, as a contribution to the analysis of the world's source potential, a study is made of industrial carrying capacity, which may defined as the capacity of the earth's resources to sustain the industrializa- on implied by the Lima target. Thus, the requirements for industrialization e analysed below in terms of three important and limited resources: labour, w materials and energy. At the same time, consideration is given to the way which industrialization contributes to over-all economic growth and changes e structure of economies.

In order to carry out an analysis of the demand for the important sources and the extent to which, in the future, it can be met, it is necessary to evelop an economic scenario which provides a picture of the world's economy er the next few decades. Such a picture must not only include expectations garding the behaviour of significant economic variables but must also corporate the goals that have been espoused by the international community. ne scenario has been drawn up on the basis of the LIDO model,[1] and corporates the achievement of the Lima target in the year 2000. It is thus a enario of industrialization in which the developing countries meet the goal of per cent of the world's manufacturing production by the year 2000.

The following section contains an analysis of employment. By taking the IDO scenario and analysing its implications for employment in the regions ing considered here, it is possible to assess the relative position of demand d supply, given the population estimates available for the year in question.

The next section analyses the essential input of raw materials for anufacturing. The analysis is carried out in terms of demand and supply for a umber of key minerals, using estimates of the world's present and expected sources of this kind, and incorporating the economic scenario.

The third section deals with the third resource necessary for industrializa- on, namely, energy. It analyses existing and expected future stocks of both aditional and non-conventional energy supplies. It again bases its estimates of ture supply and demand on the LIDO scenario.

The world employment potential[2]

In discussing the world employment potential, the question arises whether e absorptive capacity of the economic system is sufficient to accommodate e vastly increased labour forces of the future.

[1]This is the scenario for the Third United Nations Development Decade, described in the ceding article.

[2]Throughout this section, the centrally planned economies of Asia are excluded.

In order to be able to analyse the employment potential, two modifications had to made to the original LIDO scenario.

First, while the original scenario distinguished the four economic sectors, agriculture, mining, manufacturing and "others", the data available on the labour force permit disaggregation into three sectors only, namely, agriculture, industry and services. Mining and manufacturing therefore had to be condensed into one sector. Furthermore, the construction sector had to be reallocated to the newly formed industry sector.[3]

Secondly, it was felt that, in view of the significant structural differences involved, the developed countries should be split into market and centrally planned economies. It was assumed that the historical growth differential between these two subgroups of developed countries of approximately 2 percentage points would persist in the future. On the basis of this assumption, the growth rates of GDP and the sectoral values added could then be analytically determined for both subgroups.[4]

Tables 1 and 2 give the annual growth rates by economic sector and region that were determined on the basis of the above modifications. The most striking feature of the modifications is that, for the developing as well as the developed countries, the service sector will now have the highest expansion rate. This is primarily due to the inclusion of mining in industry, since the mining sector in the original scenario is expected to grow only at a slow rate.

Table 1. Annual growth rates of GDP and sectoral value added, by region/economic grouping, 1975-2000

(Percentage)

Region/economic grouping	*Agriculture*	*Industry*	*Services*	*Total GDP*
Africa	2.61	7.05	7.09	6.25
Asia	3.72	8.74	8.54	7.47
Latin America	4.50	8.01	8.62	8.03
Middle East	2.38	5.58	8.66	6.56
Total developing countries	3.60	7.46	8.42	7.39
Developed market economies	2.75	2.86	3.57	3.26
Developed centrally planned economies	2.39	5.71	5.30	5.26
Total developed countries	2.61	3.77	3.83	3.74

[3]This was done by applying the sectoral shares of the construction sector in the total GDP for the base year of the scenario (1975) in each region to the projections as well. The assumption of (limited) structural constancy seems to be justified, as an evaluation of cross-country and cross-regional data yielded no convincing evidence of a stable relationship between the share of the construction sector in total GDP and the level of economic development.

[4]While the growth rates of GDP of the two subgroups can be determined straightforwardly on the basis of the above assumption by a simple calculation involving logarithms, the sectoral growth rates were determined in a second step iteratively by an RAS procedure.

Table 2. Annual growth rates of GDP and sectoral value added, by aggregated regions, 1975-2000

(Percentage)

Economic grouping	Agriculture	Industry	Services	Total GDP
Developing countries	3.60	7.46	8.42	7.39
Developed countries	2.61	3.77	3.83	3.74

The development of labour supply and requirements

Productivity trends

The discussion of employment potential rests upon the labour-force requirements that accompany economic development. These requirements are determined by the corresponding development of labour productivity (output *per capita*) in each sector and region. In order to be able to make appropriate assumptions with regard to the development of labour productivity over a period of time and its relationship to economic growth, the evolution of labour productivity over the period 1960-1975, and subperiods thereof, was analysed. Tables 3, 4 and 5 give the actual levels of labour demand and its sectoral distribution in 1960 and 1975 and the relationship of productivity to economic growth for the period 1960-1975.

This analysis of growth rates and elasticities was supplemented by econometric analyses of productivity development on the basis of cross-section and time-series data. While the cross-section analyses did not yield useful results (a failure that may be explained by the peculiarities of the available sample), the time-series analyses for individual and especially for grouped countries gave results that were strikingly similar to the values obtained above. This correspondence between the results of the comparison of various points of time for all the regions and the time-series analysis of groups of countries in each region indicates that the results obtained—with the exception of the service sector—are a good representation of actual developments.

Table 3. Assumed elasticities of productivity growth with respect to value added, 1975-2000

Region	Agriculture	Industry	Services
Africa	0.20	0.45	0.45
Asia	0.50	0.55	0.60
Latin America	0.70	0.50	0.50
Middle East	0.80	0.45	0.50
Total developing countries[a]	0.53	0.49	0.57

[a]Implicit elasticities calculated as the weighted average of the four regions.

The results of the foregoing analyses are applied in conjunction with the modified LIDO scenario to assess the development of labour-force requirements by economic sectors and regions up to the year 2000. Table 3 gives the elasticity values that were used for the developing regions.

For the material production sectors (agriculture and industry) in developed countries, growth rates for labour productivity, rather than elasticities, were specified. The major reason for this assumption was that in the future technical progress could be expected to evolve autonomously in the developed countries. In agriculture it was assumed that labour productivity in all developed countries would increase at an annual rate of 4.5 per cent, and in industry at

Table 4. Development of the demand for labour, by economic sector and by region/economic grouping

(Millions of persons)

Region/economic grouping	*Agriculture*	*Industry*	*Services*	*Total*
Africa				
1960	83.1	8.0	14.2	105.4
1975	100.9	17.1	25.1	143.1
2000	168.9	43.6	64.4	276.9
Asia				
1960	236.3	32.8	53.3	322.4
1975	294.1	53.0	85.4	432.4
2000	464.3	136.0	193.8	794.1
Latin America				
1960	33.5	14.0	22.4	70.0
1975	38.8	25.0	41.8	105.5
2000	54.0	65.5	117.5	237.0
Middle East				
1960	19.1	4.1	5.0	28.2
1975	21.0	7.4	9.8	38.1
2000	23.6	15.6	27.7	66.9
Total developing countries				
1960	372.0	58.9	94.9	526.0
1975	454.8	102.5	162.1	719.1
2000	710.8	260.7	403.4	1 374.9
Developed market economies				
1960	51.0	101.3	116.3	268.5
1975	33.6	113.4	174.6	321.5
2000	21.5	109.0	258.6	389.1
Developed centrally planned economies				
1960	73.1	50.0	44.8	167.9
1975	50.7	81.5	61.9	194.0
2000	29.7	106.5	85.5	221.7
Total developed countries				
1960	124.0	151.3	161.1	436.4
1975	84.2	194.9	236.4	515.5
2000	51.2	215.5	344.1	610.8

Table 5. Development of the demand for labour, by economic sector and by region/economic grouping: distribution by sector

(Percentage share)

Region/economic grouping	Agriculture	Industry	Services
Africa			
1960	78.8	7.6	13.5
1975	70.5	11.9	17.5
2000	61.0	15.7	23.2
Asia			
1960	73.3	10.2	16.5
1975	68.0	12.3	19.8
2000	58.5	17.1	24.4
Latin America			
1960	47.9	20.0	32.1
1975	36.8	23.7	39.6
2000	22.8	27.6	49.6
Middle East			
1960	67.7	14.5	17.7
1975	55.1	19.4	25.7
2000	35.3	23.3	41.4
Developed market economies			
1960	19.0	37.7	43.3
1975	10.5	35.2	54.3
2000	5.5	28.0	66.5
Developed centrally planned economies			
1960	43.5	29.8	26.7
1975	26.1	42.0	31.9
2000	13.4	48.0	38.6

.5 per cent in the developed market economies and 4.5 per cent in the developed centrally planned economies. On the other hand, productivity growth in the service sector was considered to be primarily output-dependent, with elasticities of 0.55 and 0.75 for the developed market and centrally planned economies, respectively.[5]

In general, the specified growth rates or elasticities are quite close to the historical values. Since, in most cases, elasticities are used instead of growth rates, the adjustment to increased levels of growth in developing countries was taken into account, thus avoiding the errors that would arise from the use of inconsistently specified growth rates. The elasticities of the service sector were raised throughout in order to take account of the above-mentioned biases.[6] Finally, it was assumed that the development of labour productivity would not

[5]This is especially necessary, as the methodology of the original scenario (an input-output approach) does not possess this implicit downward bias for the service sector, even when the projection is made in constant 1975 prices.

[6]The above assumptions regarding elasticities and growth rates are based on an evaluation of the historical values given above, the values of the intermediate periods between 1960 and 1975, and the results of the supplementary analyses.

come to a standstill, as some experiences might indicate. Given the rationaliza- tion potential indicated by large intercountry productivity differentials in many industries, and taking a not too pessimistic view of future investments and innovations, the above assumption seems to be justified.

Labour supply and requirements up to the year 2000

The economic growth implied by the achievement of the Lima target will therefore yield, by the year 2000, the labour requirements shown in table 4 and in the figure below. Table 5 gives the changes in the sectoral distribution of the labour force according to this development pattern.

The labour supply projections for the year 2000 were taken from International Labour Office sources. The projected labour supply for the year 2000 is 273.4 million in Africa, 767.5 million in Asia, 207.3 million in Latin America and 75.3 million in the Middle East. In the developed market economies it is 391.3 million and in the developed centrally planned economies 217.0 million. As shown in table 6, this gives 1,323.5 million in the developing and 597.7 million in the developed countries. Available supply is matched, and even marginally exceeded, by requirements (51.4 million—or 3.9 per cent—excess demand for the developing countries and 13.1 million—or 2.2 per cent—excess demand for the developed countries).

The major result is that, given the implied high economic growth rates, the labour force will be absorbed by the economic system by the year 2000, that is

Development of the demand for labour, by economic sector and region, 1960, 1975 and 2000

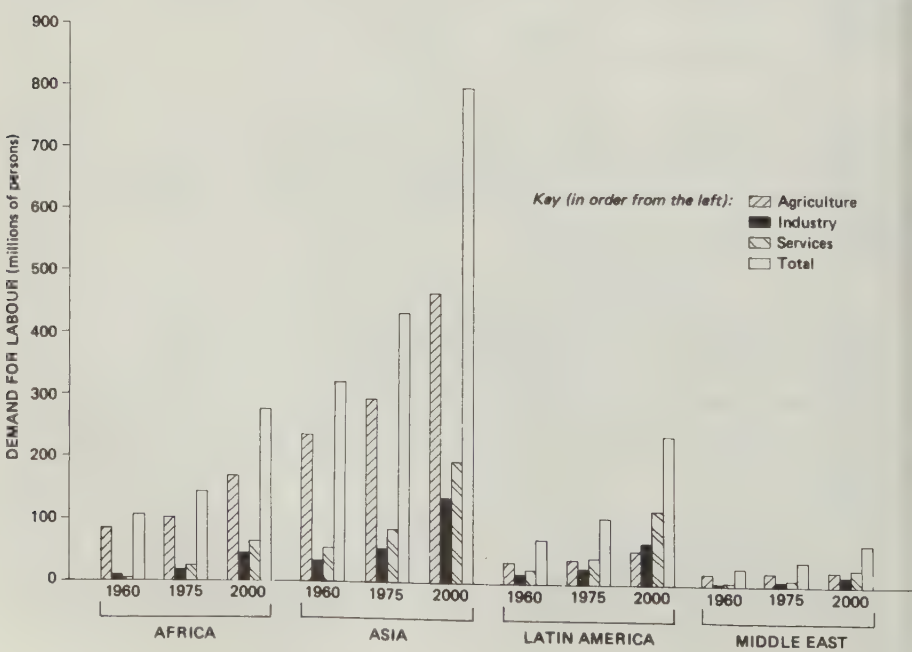


Table 6. Population and the supply of labour

conomic grouping	Population (millions)	Labour force (millions)	Participation rate (percentage)
eveloping countries[a]			
1975	2 015.8[b]	719.1[b]	35.7
2000	3 668.3[c]	1 323.5[d]	36.1
eveloped countries			
1975	1 122.1[b]	515.5[b]	45.9
2000	1 305.1[c]	597.7[d]	45.8
otal			
1975	3 137.9[b]	1 234.6[b]	39.3
2000	4 973.4[c]	1 921.2[d]	38.6

[a]Excluding the centrally planned economies of Asia.
[b]Estimates.
[c]Population projection by the United Nations.
[d]ILO labour-force projections for the year 2000.

he increase in employment opportunities will be sufficient to provide work for he rapidly growing labour forces, especially those of the third world. The over-ll conclusion can nevertheless still be drawn, that the application of istorically plausible relationships concerning productivity development to this cenario of an admittedly accelerated economic growth leads to a surprisingly vell-balanced picture for the year 2000.

The adequacy of non-fuel minerals

The recent debate on the adequacy of the world's endowment of non-fuel nineral resources for future growth and economic development was initiated y the first Club of Rome study, *The Limits to Growth*, according to which nineral resources would be totally depleted within the next century. While it is enerally agreed that there is no immediate danger of resources being xhausted, there are two opposing views on the long-term perspectives. The rst one holds that mineral resources are very limited and that unchecked conomic growth would imply total depletion in the near future; consequently, ne world economy, because of shortages and rising costs of minerals, would oon come to a halt. The more optimistic position, on the contrary, assumes nat new discoveries, technological progress both in mining and manufacturing nd changing economic conditions would continue to provide sufficient mineral upplies for the world's economy.

An assessment is made below of the future demand and supply conditions f the most important non-fuel minerals, namely aluminium, copper, iron, lead, ickel, tin and zinc; the results are then compared with the demand implied by ne Lima target. All of these minerals are metals, and taken together they ccount both in value and physical quantity for by far the largest portion of the orld's total non-fuel mineral production or consumption.

The concepts of reserves and resources

There are two common concepts of the availability of minerals: reserve and resources. On the one hand, G. Govett and M. Govett define reserves a the quantity of ore available in the ground which is exploitable under presen economic and technical conditions [1]. Generally, these identified reserves— which include measured, indicated and inferred reserves—are expressed i mineral (metal) content, which is computed on the basis of the measured o estimated average grade of the identified deposits. By its very nature thi definition is dynamic. As new deposits are identified, and as changes in minin technology and economic conditions make hitherto sub-economic deposit economically exploitable, the reserve figures can be expected to rise.

Furthermore, since mining companies often try to maintain a constan ratio of reserves to production of 25 or even higher, depending on the numbe of years that may be considered a convenient lead time to bring new deposit into production, reserves in many instances tend simply to grow in line wit annual production [2]. Thus, the current reserve figures can certainly not b taken as indicators of future availability; they serve, rather, as a measure of th amount of minerals that can be mined without the need for increased minera prices or major technological breakthroughs. They constitute the potentia supply of minerals, the "real" cost of which will be no higher than it is today.

On the other hand, as noted by Radetzki, "Resources, as a concept include reserves at one end of the scale and grades, down to the finite limit o an element represented by the average amount present in the rock of a regio (including offshore areas and the oceans)" [3]. The total of resources consists o reserves, currently known deposits which are not exploitable for economi and/or technical reasons, and finally the currently unknown deposits composed of hypothetical resources in known districts and speculativ resources in unknown districts. Again, as with reserves, these resource estimate are not to be thought of as an inventory of ultimately recoverable amounts o minerals, for they are themselves of a dynamic nature. Estimates of resource are generally based upon geological knowledge and hypotheses (according t geological similarities and other criteria), on the one hand, and reasonabl assumptions about the least mineable grades of various minerals, on the other.

Thus, most of the resource estimates are in one way or another the resul of past exploration activities and an evaluation of technical possibilities, th totals being arrived at by summing up the available estimates of known an likely resources of individual deposits, regions etc. As they account onl partially for still undiscovered resources, the estimates tend to be rathe conservative and to underestimate the amounts of minerals that will b available in the long run [1].

The development of reserves and resources

Tables 7 and 8 give a survey of the current knowledge of reserves an resources of the seven metals, from which it can be seen that reserves increase rapidly, at annual rates that were in general comparable to the growth rates c production or consumption. That the supply of minerals has up to now bee

Table 7. Development of estimated world mineral reserves[a]

(Millions of tons)

ear	Aluminium	Copper	Iron	Lead	Nickel	Tin	Zinc
947/48[b]	1 400	100	19 000[c]	40	. . .	6	70
950[d]	505	210	61 000	. . .	. . .	. . .	. . .
968[e]	1 060	200	80 000	86	67	4.5	112
973[f]	3 270	335	88 000	130	42	4.3	120
974[d]	3 480	408	90 600	. . .	. . .	. . .	. . .
974[g]	3 480	408	91 000	150	54	10	236
976[h]	5 600	503	103 000	136	60	10	166

[a]Identified resources, economically recoverable at current prices, using current technology.

[b]G. J. S. Govett and M. H. Govett, "The concept and measurement of mineral reserves and esources", *Resources Policy*, September 1974.

[c]Excluding the Union of Soviet Socialist Republics, which accounts for over two fifths of the orld's reserves.

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[h]*Entering the 21st Century: Global 2000 Report* (Washington, D.C., Government Printing Office, 980).

Table 8. Estimates of world mineral resources[a, b]

(Millions of tons)

	Source			
ineral	Rajamaran (1973)	Radetzki (1974)	Walker (1974)	United States Government[c] (1977)
luminium[d]	—	6 310	5 720	8 000
opper	1 335[e]	1 450	1 860	2 220[f]
on	230 000	195 000	195 000	236 000[g]
ead	1 685	. . .	. . .	1 370
ickel[h]	105	. . .	112	157
in	37	. . .	21	37
inc	5 090	. . .	1 506	4 160

[a]Resources include reserves (identified and recoverable resources), other identified resources nd undiscovered (unidentified) resources (hypothetical in known districts and speculative in unknown stricts).

[b]The estimates are shown according to the source. The year in parentheses indicates the year for hich the estimate was made.

[c]*Entering the 21st Century: Global 2000 Report* (Washington, D.C., Government Printing Office, 980).

[d]Figures are for bauxite only. If clays are included, resources are considered to be abundant.

[e]Excluding deep-sea nodules.

[f]Including 690 million tons of copper from deep-sea nodules.

[g]Iron ores with an iron content of 26 per cent and over.

[h]Excluding undiscovered resources and deep-sea nodules.

sufficient, and that there are no signs of imminent shortages, can b
demonstrated not only by analysing physical quantities but also by studying th
development of prices and costs. Even granting an imperfect functioning of th
markets, due to lack of foresight and other factors, increased scarcity wou
eventually have to lead to rising costs and prices for these materials. Th
question has been analysed, and the conclusion is generally that the costs ar
prices of almost all extractive output have in the long run been falling and tha
in the more recent past, this fall has either continued, albeit at a slower pace, o
has even come to a halt.

To sum up, there has been very little evidence until now of any critic
shortage of mineral supplies. On the contrary, estimated reserves have bee
steadily increasing; the ratio of reserves to production has in most cases at lea
been maintained, and the economic indicators (costs and prices) have given n
clear signal of imminent shortages.

Because of their importance, aluminium, copper and iron were analyse
within the LIDO model scenario up to the year 2000 in a region
disaggregation (market and centrally planned economies, both developed an
developing), whereas for the other metals only the world totals were studie
Table 9 gives the assumed elasticities between consumption and GDP fo
aluminium, copper and iron, and thus the implied annual growth rates fo
consumption by region.[7] The given values correspond, by and large, t
historical values since the mid-1960s. For the other minerals, the elasticit
assumptions (again corresponding to historical values) concerning the relatio
between the world's total consumption and the growth of world gross produ
are as follows:[8] lead, 0.5; nickel, 0.9; tin, 0.3; and zinc, 0.6. Table 10 gives th
development of consumption of the seven selected non-fuel minerals, dete
mined on the basis of the above assumptions, in the context of the Lim

Table 9. Assumed elasticities with respect to economic growth an corresponding annual growth rates of mineral consumption in th Lima scenario for the period 1975-2000

	Developed countries				Developing countries			
	Market economies		Centrally planned economies		Market economies		Centrally planned economies	
Mineral	Elasticity	Growth rate (percentage)	Elasticity	Growth rate (percentage)	Elasticity	Growth rate (percentage)	Elasticity	Growth ra (percentag
Aluminium	1.25	4.1	1.00	5.3	1.50	11.1	...	10.2
Copper	0.40	1.3	0.90	5.0	1.40	10.3	...	9.0
Iron	0.40	1.3	0.70	3.7	1.15	8.5	...	7.3

[7]The centrally planned developing economies were not included in the LIDO scenario and therefore had to be assumed that the historical rates of growth of consumption would continue to the year 2000.

[8]World GDP is assumed to grow at an annual rate of 4.5 per cent between 1975 and 2000.

Table 10. Development of world mineral consumption from 1975 to 2000

(Millions of tons)

	Developed countries		Developing countries		
Mineral	*Market economies*	*Centrally planned economies*	*Market economies*	*Centrally planned economies*	*World as a whole*
Aluminium					
1975[a]	9.3	2.5	0.9	0.3	13.0
2000: Lima scenario	30.0	9.0	12.5	3.4	54.9
2000: *Global 2000 Report*[b]	...	...	...	...	49.3
Copper					
1975[a]	5.5	1.8	0.5	0.3	8.1
2000: Lima scenario	7.6	5.7	5.8	2.6	21.7
2000: *Global 2000 Report*[b]	...	...	...	...	16.0
Iron[c]					
1975[a]	419	191	31	31	672 (523)
2000: Lima scenario	579	472	238	179	1 468 (1 121)
2000: *Global 2000 Report*[d]	...	...	...	...	... (1 031)
Lead					
1975[a]	...	...	...	...	4.2
2000: Lima scenario	...	...	...	...	7.3
2000: *Global 2000 Report*[b]	...	...	...	...	7.8
Nickel					
1975[a]	...	...	...	...	0.65
2000: Lima scenario	...	...	...	...	1.58
2000: *Global 2000 Report*	...	...	...	...	1.40
Tin					
1975[a]	...	...	...	...	0.23
2000: Lima scenario	...	...	...	...	0.33
2000: *Global 2000 Report*[b]	...	...	...	...	0.39
Zinc					
1975[a]	...	...	...	...	5.6
2000: Lima scenario	...	...	...	...	10.9
2000: *Global 2000 Report*[b]	...	...	...	...	13.2

[a]Average consumption, 1974-1976.

[b]Projections according to the 1976 consumption figures and growth rates given in *Entering the 21st Century: Global 2000 Report* (Washington, D.C., Government Printing Office, 1980).

[c]Production of crude steel. Corresponding iron ore requirements in parentheses. It is assumed that the ratio of iron ore to crude steel will not change.

[d]Projections according to the 1976 requirements of iron ore given in *Statistical Yearbook*, various issues, and growth rates as given in *Entering the 21st Century: Global 2000 Report*.

scenario.[9] For purposes of comparison, alternative projections corresponding to the figures in the United States Government report *Entering the 21st Century: Global 2000 Report* [4] and the recent major analyses of the future development of mineral demand and supply are also given in table 10.[10] The Lima scenario is a normative one, analysing the effects of accelerated industrialization, while the *Global 2000 Report* represents an attempt to project the likely developments.

Table 11 illustrates the implications of these two development paths for the use of currently known economically recoverable reserves. Cumulative consumption until the year 2000 and the current reserves which will have been used

Table 11. Cumulative consumption of minerals and depletion of reserves

Mineral	*World cumulative consumption until 2000 (millions of tons)*	*Cumulative consumption in relation to current reserves (percentage)*	*Year reserves will be exhausted with 1975-2000 growth in consumption*
Aluminium			
Lima scenario	632	11.3	2032
Global 2000 Report	746	13.3	2039
Copper			
Lima scenario	327	65.0	2007
Global 2000 Report	293	58.3	2011
Iron			
Lima scenario	18 900	18.3	2039
Global 2000 Report	17 800	17.3	2042
Lead			
Lima scenario	140	93.3	2001
Global 2000 Report	132	88.0	2002
Nickel			
Lima scenario	26	43.3	2016
Global 2000 Report	24	40.0	2019
Tin			
Lima scenario	6.9	69.0	2009
Global 2000 Report	7.4	74.0	2006
Zinc			
Lima scenario	199	84.3	2003
Global 2000 Report	225	95.3	2001

[9]The starting values are average 1974-1976 consumption figures instead of the 1975 figures, to account for the fact that in 1975 metal production and consumption were extraordinarily low because of the sharp fall in economic activity in 1975. In the case of iron, crude steel production was used instead of iron consumption. These figures then have to be converted into demand for iron ore, which, because of recycling in the iron and steel industry, will be considerably lower. The data for both the statistical analysis of past development and the starting values were taken from a UNIDO survey of mineral production and consumption.

[10]For the *Global 2000 Report*, the projections were not directly available, but had to be reconstructed from the current consumption figures and the expected growth rates given in that report. Some discrepancies result, as the base-year dates of the projections do not always correspond, but in general the correlation seems to be rather good. The base year for the *Global 2000 Report* is 1976.

y then are given for both projections. In addition, the date when the currently nown reserves would be exhausted if the 1975-2000 growth in consumption ere to continue is also calculated.

The uniform result of the foregoing is that none of the currently known eserves will be exhausted by the year 2000. Thus, even on the most extreme ssumption that technological development will come to a standstill and that o new discoveries will be made, current reserves are adequate to meet the emand for minerals even in the case of a relatively high-growth industrializa-on scenario. Comforting as this result might at first seem, the fact remains iat a further continuation of the trends up to the year 2000 would lead to the xhaustion of reserves within sometimes surprisingly short periods after the ear 2000.

Conclusions and further outlook

While it is certainly disquieting to learn that the current knowledge of iineral reserves and resources seems to give no immediate assurance of the dequacy of mineral supplies in the long run, potential supplies are nevertheless ill sufficient to sustain even an accelerated industrialization for quite a long eriod. A more detailed analysis of important non-fuel minerals, where iortages seem to be most likely to occur in the next century, shows that otential supplies can be expected to suffice for a considerable time to come, ther because alternative sources have been found or because improvements ave been made in mining technology.

The energy dimension

While the limitations of the world's energy resources had already been nown in principle, the energy crisis of 1973 appreciably increased the general wareness that a world energy problem existed. Since then, the long-term erspectives of world energy demand and supply have been analysed in a large umber of studies, such as those by the International Institute of Applied ystems Analysis, the World Energy Conference and the Workshop on lternative Energy Sources, and the variance among these projections specially after the year 2000) is large. The differences stem mostly from arying assumptions regarding economic growth on the one hand and the elationship of energy consumption and economic activity (commonly measured y an elasticity) on the other. For this reason, a separate analysis was made of ie energy implications of the Lima scenario.

For the period 1975-2000, the development of primary energy require-ients was studied separately for commercial and non-commercial energy for ie four regions. The development of commercial energy was evaluated by asticities, whereas for the development of non-commercial energy, Frisch's rojections for developing countries were taken [5].[11]

[11]For the developed market economies, the elasticity decreases from 0.87 (1975-1980) to 0.82 980-1990) and to 0.70 (1990-2000). The corresponding values for the centrally planned veloped economies are 0.80, 0.77 and 0.70, whereas for the developing market economies 1.15,)5 and 0.85 have been assumed. It is assumed in Frisch's projections that non-commercial energy ll remain constant in the developed countries.

On the basis of these assumptions, primary energy consumption will increase from 6,700 million tons of oil equivalent (mtoe) in 1975 to 16,740 mtoe by the year 2000. These would rank high compared with the other projections, the main reason for the difference being the higher economic growth rates necessary in the LIDO scenario for the Lima target to be attained, though the elasticities fall within the commonly accepted range (see table 12).

Table 12. Primary energy requirements, by region

(Millions of tons of oil equivalent)

	Developed countries		*Developing countries*		
Year	*Market economies*	*Centrally planned economies*	*Market economies*	*Centrally planned economies*	*World as a whole*
1975					
Commercial energy[a]	3 580	1 395	650	435	6 060
Non-commercial energy[b]	50	5	455	130	640
Total	3 630	1 400	1 105	565	6 700
2000					
Total[c]	6 715	3 540	4 425	2 060	16 740

[a] *World Energy Supplies 1973-1978* (United Nations publication, Sales No. 79.XVII.13).

[b] J. R. Frisch, *Third World Energy Horizons, 2000-2020*, Monograph submitted to the World Energy Conference held at Munich from 8 to 12 September 1980.

[c] Lima growth scenario.

Turning to the question whether these energy requirements can be met from currently known or possible energy sources, the distinction must again be made between reserves and resources. Tables 13 and 14 give the currently available reserves and the resource estimates respectively. With these figures, some tentative conclusions can be drawn regarding the availability of energy. But, it must also be remembered that the definition of reserves implies not only technological but also economic criteria and the figures for most reserves of energy will therefore display certain dynamics when energy prices rise.

Taking only the non-renewable energy sources (that is, excluding the renewable resources, such as hydropower or biomass conversion), energy requirements could, at least in principle, be met beyond the year 2000 by the known proved recoverable reserves. Even if the implications—such as high rates of coal liquefaction and the rapid expansion of nuclear power—are drastic, this result is still remarkable for two reasons. First, hydropower and other renewable energy sources would lengthen this span even further; secondly, no allowance has yet been made for the introduction of breeder reactors.

Yet, optimistic as this picture may be, it hides some serious constraints to further development. Implicitly it has been assumed that the different energy sources are to a large degree replaceable, and, probably much more seriously that appropriate measures are being taken to produce the required supplies

Table 13. Estimated energy reserves

(Billions of tons of oil equivalent)

Energy resource	*Proved recoverable reserves*	*Recoverable additional resources*
Conventional oil[a]	90	230
Unconventional oil		
Tar sands	40	76
Oil shale	46	293
Natural gas	63	163
Coal		
Hard coal	325	246[b]
Brown coal/lignite	140	158[b]
Uranium[c]	43	59
Total	747	1 225

Source: Federal Institute for Geosciences and Natural Resources, *Survey of Energy Resources* (Hannover, 1980), submitted to the World Energy Conference held at Munich from 8 to 12 September 1980.

[a]Including estimated proved recoverable reserves and estimated recoverable additional resources of natural gas liquids.

[b]Assuming that only 6 per cent of the additional reserves in place are recoverable, which is in fact slightly below the current average of 6.2 per cent.

[c]For a uranium price of up to $130 per kilogram, where uranium is used in light water reactors.

Table 14. Estimated energy resources

(Billions of tons of oil equivalent)

Energy resource	*Estimated resources*	*Technically recoverable resources*	*Currently economically recoverable resources*
Conventional oil	700	290	90
Unconventional oil			
Tar sands	350	520	70
Oil shale	490		
Natural gas	280	210	70
Coal			
Hard coal	5 600	840	420
Brown coal/lignite	1 400		
Uranium used for			
Light water reactors	. . .	170	80
Breeder reactors	. . .	10 500	4 550
Total		12 530	5 280
		2 030[a]	730[a]

Source: Mobil Oil AG, Federal Republic of Germany (1979).

[a]Excluding breeder reactors.

This implies, *inter alia*, a drastic shift in the type of energy used. Most of all, it implies that substitutes must be found for conventional crude oil. According to an unpublished UNIDO study on the dimensions of energy requirements and the Lima target, realistic estimates show that, given the current structure of energy consumption, the supply of conventional crude oil will be insufficient to meet demand after 1995.

There is thus both the urgent necessity for, and the possibility of, adopting the so-called "replacement fuel" strategy. Even for the projection period, it will be absolutely necessary on the one hand to shift the current fuel basis to new fuels such as unconventional crudes, coal and nuclear power, and on the other hand to promote energy conservation and the development of renewable resources.

Summary and conclusion

In this article, a study has been made of industrial carrying capacity in three major areas—labour, natural resources and energy—to assess their availability and the extent to which supply can meet the demand implied by the achievement of the Lima target by the year 2000. The analyses were based on a normative development scenario of the implications of the Lima target, derived from the LIDO model.

The chief findings of the study are set out below.

First, an analysis of the development of labour productivity and the world's employment potential using relatively high growth rates of labour productivity based upon historical developments since 1960 shows that, in principle, the rapidly increasing labour force could be productively employed.

Secondly, an examination of seven important non-fuel minerals reveals that, even with very high rates of consumption growth, resources will not be exhausted. There is sufficient time to develop further (alternative) mineral resources, which could sustain the world's economy at high levels of mineral consumption for a very long time.

Thirdly, the energy supply potential of the world is sufficient to sustain the levels of energy demand that are generated by the higher rates of economic growth and development implied under the LIDO scenario. The crucial problem is that a temporary bottle-neck will be created in the early 1990s owing to inadequate supplies of conventional crude oil. This means that the developed countries should adopt policies to conserve energy (and especially crude oil), that the developing countries—where the potential for energy conservation is very limited—should be given preferential access to the world's stock of crude oil, and that the industrializing countries should make a major financial commitment to the further development of replacement fuels. For the longer-term transition to a new pattern of energy demand and supply, however, sufficient quantities of coal, non-conventional oil and nuclear energy are available.

Thus, it may be concluded that neither economic nor possible physical constraints need present insurmountable barriers to further global development. It has not been possible to include all the possibly relevant interrelations and linkages in this exercise. A notable omission is the relation between the environment and human (economic) activity.

Even the inclusion of additional factors need not alter the conclusion eached regarding industrial carrying capacity. Insufficient international co-peration and collective action to tackle the common problems of the world ould, however, increase the uncertainty about the future, particularly for the eveloping countries.

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'he UNITAD project: a world model to explore nstitutional changes over the long run

*UNITAD team**

Introduction—the setting of the study

This article presents some preliminary results of the UNITAD project, ıitiated in 1978 at the request of the Task Force on Long-term Development ›bjectives of the Administrative Committee on Co-ordination (ACC). inanced by a special fund, the project was carried out jointly by the United 'ations Conference on Trade and Development (UNCTAD) and UNIDO and ɔonsored by the Department of International Economic and Social Affairs of ıe United Nations Secretariat. The first phase of the UNITAD model was ɔmpleted at the end of 1980 and UNIDO is developing the model further and aborating development scenarios. The purpose of the project was to explore ith an analytical tool—the UNITAD system of models—the effect of lternative development strategies on the prospects of various regions of the orld economy, especially in the areas of industrialization, trade and growth. lore generally, the project was meant to contribute to an understanding of the ructural transformations that would be necessary in North-South relations and ithin the domestic sector of developed and developing countries in order to btain a more equitable system of international economic relations.

The scope of the model has been broadened so as to include some crucial ɔng-term aspects of development. Indeed, because of the generally acknow- dged failure of traditional development policies, the poor performance of ıost developing countries and the persistence of and increase in the most vident forms of poverty, both development thinking and modelling are now ɔcused on a wide range of issues.[1] These issues include the relation between ıcome distribution and growth; the mobilization of productive resources such s labour, land and knowledge, which too often remain grossly under-used; and ıe balanced growth of the economy, in which agriculture and industry reinforce ne another through a progressive expansion of their absorptive capacity. An oquent echo of the importance of such issues is also found in the ıternational Development Strategy for the Third United Nations Development ecade (General Assembly resolution 35/56, annex).

Simultaneously, the changes that have occurred in recent years call for new ɔproaches and solutions, even when dealing with traditional problems such as ıose relating to trade and industrialization. For instance, the now widely shared wareness of the fact that the developing countries cannot expand indefinitely

*The UNITAD team was responsible for the conduct of a joint UNIDO/UNCTAD project ı global modelling, partly financed by special voluntary contributions. The team was composed of Duval (UNCTAD consultant) and two members of the UNCTAD secretariat.

[1]For relatively recent reviews of global models, see Cole [1] and Richards [2]. See also Gupta d others [3], Leontief and others [4] and Hopkins and van der Hoeven [5].

on the basis of the growth of the export markets of the more advanced nations (which seem to have entered a long period of stagnation) has given a more realistic foundation to policies of collective self-reliance. Very often, however, the implications of increased economic co-operation among developing countries have remained largely unexplored [6], partly owing to the limited capability of most existing global models to handle such issues. Little information, even of a very general nature, is to be had on the real chances or limitations of policies designed to bring about substantial changes in world industry and in the direction and structure of world trade. Thus, if these problems are to be tackled quantitatively, they have to be given definite shape and new tools have to be devised to deal with them.

Similarly, although the concept of appropriate technology has recently gained wide currency, the real scope for its application, as well as its implications in terms of trade, growth and over-all development, have seldom been explored systematically by means of global models. Here too, new concepts, approaches and information need to be developed if this important aspect of development policies is to be thoroughly analysed.

Lastly, as far as is known, there has been little attempt to examine the relative importance and the interactions of policy issues and decisions concerning the so-called "external sector" (trade, capital flows, aid etc.) on the one hand, and the "domestic sector" on the other. Admittedly, theoretical elaboration in this area is still lagging behind, but in reality the external and the domestic sectors interact very closely, and to restrict the analysis to the functioning of only one of the two would be very misleading indeed. The UNITAD project was therefore required to examine the relative efficiency of domestic versus international policies in attaining given developing targets.

To explore these broad issues, even in a rudimentary way, it was felt that a semi-disaggregated world and economy-wide model was necessary, guaranteeing the consistency of all aggregates. The model specification should also explicitly include variables that represent or approximate the new issues and permit an innovative approach to the old ones.

The efforts made in this direction are described in chapter I below, which deals with the structure and functioning of the model. The model itself is now reasonably complete and can be used for simulation purposes, but it is still far from being a finished piece of work. Its structure, for instance, could be further refined and some of the initial estimates could be improved. Nevertheless, the results obtained with the model as it stands already appear to provide some interesting insights into the problems of industrialization, trade and potential growth over the next two decades. Chapter II shows the results of the simulation of two scenarios and the summary and conclusions follow in chapter III.

I. Structure of the model

A. Selection of the structure

The model and its working properties are described in sections B and C below and in the annex.[2] The present section illustrates the main methodological features of the model that it was thought would capture the policy issues

[2]For a complete set of the equations used, see UNIDO [7].

elled out in the introduction while keeping the econometric estimation and mputer work within manageable limits.

Any model's specification is influenced by its purpose, the availability of ata and existing methodologies. The main distinction usually drawn for owth models is between the demand-driven and supply-driven types. The latter pe explains growth mostly in terms of the existing stock of production factors nd is generally better suited to longer-term models, especially in the case of eveloping economies afflicted by severe supply constraints and market gidities. Demand-driven models, such as those belonging to the Keynesian mily, are more suitable for explaining short-term and medium-term fluctua- ons of economies with large idle capacity and few supply constraints. This en, was the first choice to be made.

Although the UNITAD approach combines aspects of both types of odel, the UNITAD system could be described as a supply-constrained model the sense that the stock of production factors (including those transferred om abroad) does limit the assessment of the growth potential of the economy. he multisectoral nature of the model, on the other hand, allows the structure final demand to be explicitly introduced so that an alteration in its omposition (because, for instance, of changes in consumer preferences, of chnologically induced changes in investment or of changes in export demand) fects the level of gross national product (GNP). Hence, it can be said that, for given stock of production factors, the structure of demand influences not only e composition but also the level of output.

A second choice, which was strongly influenced by the time horizon of the odel (i.e. from 1980 to 1990 and 2000), had to be made between simulation nd forecasting models. The distinction between the two is often a matter of egree rather than of kind. Two main features differentiate them, however, i.e. e degree of openness of the system and the interpretation of the results. orecasting models generally have a limited number of exogenous variables vhich are controlled by the policy-maker or relate to the external environ- ent), and a dominant endogenous structure made up of sets of econometric uations with coefficients implicitly embodying past and current economic ructures. Any forecast based on such models is made on the assumption that e underlying economic structures will take their trend values as compared ith the estimation period. Under such strong hypotheses, the results of the odel can then be interpreted as the expected future (a forecast). Besides the tility of any attempt to forecast the long-term future, the rigidity of the arametric structures of such models does not, for instance, permit a mulation or generation of new industrial structures, consumption patterns or stitutional changes that would differ sharply from observed trends. Given the olicy orientation of the project, preference was therefore given to simulation odels, which are less deterministic and where a higher number of exogenous riables permits the modeller to analyse the effects and implications of ructural and institutional changes.

For example, a simulation of economic co-operation among developing untries requires the trade shares among developing countries to take certain lues, while a simulation of appropriate technology requires the technical efficients to deviate from existing trends. In this respect, the model is efinitely more open-ended. Admittedly, this can make the manipulation of the

model more difficult; the problems can be overcome, however, with the help c information derived from external data, relationships or even partial mode outside the main system, to project the range of the exogenous variables, a well as an appropriate sensitivity analysis. Obviously, the results of th simulation should be interpreted as conditional projections. They give th direction and the magnitude of change, subject to the projected values c exogenous values, i.e. with the margin of uncertainty that is imposed, at an rate, by the long-term horizon.

A related problem was that of choosing between a model which woul reproduce the year-to-year evolution of the world economic system with all th interactions of real, monetary and financial variables, and a model whic would yield a range of consistent structural targets for a final and, perhaps, few intermediate years. It is clear that, ideally, policy-makers should have bot a vision of long-term structural changes and a development path indicatin how to attain such targets. It is common knowledge, however, that it is mos difficult, if indeed at all possible, to combine the two approaches in one and th same model. Indeed, although forecasting models which allow for limite structural modifications in the economic system are normally suitable fc indicating a development path for the next few years, they should still be use with caution when one or several institutional or structural changes are takin place. This is because of the considerable uncertainty that is likely during th "gestation period" of such changes. For instance, it may take anything fror five to ten years for the economy to adjust itself to the establishment of a ne economic grouping. Past behaviour relations can not really be used to foreca the dynamics of such a process.

These arguments therefore call for a true "long-term" model, which woul not focus on the yearly fluctuations but would picture the direction of chang and attempt to describe the economic system beyond the maturation period. model such as the UNITAD system does not provide year-to-year solutions an it computes directly the results for the target years 1990 and 2000. Intermedia results for five-year intervals could be introduced if deemed necessary. For th periods included between two bench-mark years, the model assumes that stoc variables grow according to a flexible exogenous time path (arithmeti exponential etc.). From a formal point of view, the model may be considered t be primarily static. The opposition between static and dynamic, however, ca be misleading in such a context. For what is more dynamic, a model based o an assumption of rigid economic structures or a model generating ne structures or simulating the impact of institutional changes?

The third choice to be made was between a gap- and a general equilibrium type model. In other words, should the model be designed so that it woul automatically achieve equilibrium on the commodity and factor market domestically and internationally, through the operation of market-clearin prices, or should it draw the attention of the policy-makers to the potenti disequilibria (or gaps) that the world economy might face over the next 10-2 years? The former would imply an assumption of perfect competition an transparency on all markets, as well as observed conditions of quas equilibrium on the same markets. Prices, in such a context, would represe indicators of relative scarcities providing rational signals for policy decisio and allocation of resources. The assumption of perfect competition, howeve

rongly contrasts with the situation observed in several markets, where ionopoly, monopsony, oligopoly, cartelization, regulation and semi-feudal onditions are frequently found. Phenomena such as unemployment and nderutilization of land and capital, not to mention large payment deficits and flation, are eloquent manifestations of structural disequilibria and economic isorder; similarly, the price behaviour of several commodities and/or factors eveals, on closer scrutiny, the strong influence of existing power relations. urthermore, even if conditions of perfect competition did actually exist, a last uestion, rarely dealt with in the description of models, should be raised egarding methodology, namely, the aggregation problem; for example, to what xtent can "prices" of large baskets of commodities in a semi-aggregated model e treated as prices of a micro-economic nature, disregarding the changes in the omposition of the basket?

Despite some interesting recent contributions [8, 9], however, a generally ccepted over-all disequilibrium theory does not yet exist. The decision was herefore taken to design the system so as to ensure equilibrium on the ommodity markets, while generating gaps on the investment-savings side, on ie trade side and on the labour and land market. The first two gaps are qualized by the solution procedure, so that, when the growth rate of a region fixed as a target, the model generates three main gaps: the investment-savings ap (equal *ex post* to the balance of current payments), the labour gap and the nd gap. If on the other hand, one of the gaps is fixed, the model generates the rowth rate and the other two gaps. The role played by prices in such a context necessarily different from that played in a general equilibrium-type model. /hile the index prices of labour and capital are assumed exogenously, sectoral, onsumption and export price indexes are generated through the Leontief elation and the associated consumption and export converters. The export rices of agricultural products, raw material and energy include, besides the ost-component, an exogenously given price differential reflecting market nsions. Import prices are the weighted average of the partner's export prices. elative prices influence household decisions in the allocation of their onsumption expenditure among different categories of goods and services. imilarly, the ratio between import and domestic prices contributes to the egulation of import levels.

B. *Description of the model*

From the outset, the sponsoring agencies of the project made it clear that ie model should provide a bird's-eye view of the world system while remaining f a manageable size from a numerical and heuristic point of view. At the same me, despite its global scope, the model was required to display the minimum egree of detail necessary for identifying and dealing with the policy issues, and ie associated variables, towards which the system is geared. The present ection describes the choices made in this area.

The system covers 11 regions (five developed, six developing), broken own as follows: North America; Western Europe; centrally planned economies f Europe; Japan; other developed countries; Latin America; Tropical Africa; orth Africa and West Asia; South Asia; East and South-East Asia; and

centrally planned economies of Asia.[3] As is clear, the basis of the disaggrega tion adopted is, to a degree, geographical vicinity. It should be noted, in th connection, that in most cases neighbouring countries have similar econom structures and share to a large extent similar economic and social problem hence, the geographical approach overlaps in many cases with other ap proaches. Geographical vicinity, furthermore, was selected from the outset i order to provide a framework for the simulation of economic co-operatio among neighbouring countries. This strongly contrasts the UNITAD syster with other world models, in which countries are grouped according to their *pe capita* GDP level, or other economic criteria, that is, a structure implying specific linkage to the world system, better fitted to picture North-South tha South-South relations.[4]

Three different specifications of regional models have been built fo developing market economies, developed market economies and Europea centrally planned economies, respectively. The three types of models, howeve have several common features, besides adopting to a very large extent the sam production, consumption and trade breakdown. Owing to the lack of availabl information, the model of the centrally planned economies of Asia has bee considerably simplified and it plays a passive role in the system.[5] It contribute trade and financial flows to the international module but there is no feedbac of the world economy to the regional economy.

The 11 regional models are interconnected through a trade module and financial flows module. The former includes seven bilateral trade matrices, eac of which corresponds to a specific traded commodity group, and a pool c services. All traded goods and services are subdivided exhaustively into th following categories: agricultural products, other raw materials, energ intermediary products, consumer non-durables, equipment goods, consume durables and services. The financial flows module includes four pools, offici development assistance (ODA), non-concessional capital flows (including dire private investment), interest payments (including profit repatriation) an migrant remittances. Each regional model generates the import requirements a well as, when applicable, the outflows of ODA, capital movements, migrar remittances and interest payments which are associated with the pattern c growth simulated in each region. These data are fed into the trade and capit flows modules, which generate for each region the export vectors as well as th inflows of ODA, capital, interests and remittances. The trade and capital flow modules (and a few other related variables) therefore define the world trad and financial structure. Modifications in their values make it possible t

[3]The regions are geographical entities. Turkey and Yugoslavia are included in the Europea market economies, in accordance with the practice followed by the Economic Commission fc Europe. The "other developed countries" include Australia, New Zealand and South Africa. Tl Pacific islands, except Hawaii, are included in East and South-East Asia, which also includ Indonesia, Malaysia, Singapore, Thailand and the East Asian countries.

[4]Attempts are sometimes made to combine economic and geographical criteria (as, fc example, in the World Bank model). A solution of this type might eventually be worked out for tl UNITAD system, so as to introduce results by broad categories of countries within regions, fc example oil-exporting versus oil-importing countries; this, however, should be done with the he of information coming from individual country models outside the system, so as to allow a flexib breakdown (that is, capital-surplus rather than oil-exporting countries).

[5]Co-operation is now under way between UNIDO and the Academy of Social Sciences China to reconstruct the regional model for the centrally planned economies of Asia.

vestigate the effects of changes in the international environment on the owth potential of each region. As mentioned earlier, assumptions regarding orld trade and financial structures can be combined with other assumptions oout regional growth patterns so as to compare the relative efficiency of these o broad families of policies on the attainment of given targets.

Production takes place in eight sectors, namely, agriculture, agri-food, prossing, energy, basic products, light industry, capital goods industry, construcon and services. In view of their importance, energy, mining and agriculture ive received more specific treatment. Energy has been further disaggregated to four utilizing subsectors: oil extraction, utilities, coal mining, and oil fineries and coal products, so as to introduce the effects of alternative energyix. "Basic products" has been disaggregated into "other mining" and primary ocessing of raw materials. Agricultural production in developing countries is been pictured as taking place in farms of different size—small, medium and rge. The distinction is important, since it has been observed throughout the veloping world that farms of different size adopt widely diverse technologies, nd and labour use patterns and cropping intensities, which determine, cordingly, different yields per unit of land.[6] Small farms, in particular, show many regions higher resource inputs and yields per hectare than mediumzed and large farms. The introduction of farms of different sizes therefore akes it possible to simulate the effects of land distribution policies in terms of rm-output growth, labour absorption and income distribution.

Consumption and savings in the domestic sector of the economy are counted for by households, Governments and enterprises. The sum of their come equals the net disposable income of the region. Households allocate eir income between savings and eight consumption categories traditionally ed in national accounts statistics, that is, food, clothing, rent, furniture, alth, transport, education and miscellaneous. It should be noted that for the veloping regions the household sector is broken down into rural and urban ouseholds, the rural households showing a higher marginal propensity to save d consumption baskets that differ from those of their urban counterparts. In is way, the system makes it possible to simulate the effects of exogenous anges in the rural-urban income distribution. The Government allocates its sposable income between savings and current consumption in administration, fence, health and education. Again, by changing the exogenously given vernment consumption structure, it is possible to reckon the effects of ernative government expenditure patterns in terms of the over-all growth and indard of living. Enterprises, finally, are assumed to save their entire sposable income.

Breakdowns of the trade, production and consumption sectors are given in e annex.

C. *Main relations of the model*

No attempt will be made here to give an analytical expression of the 3,000 uations of the system.[7] Instead, this section will briefly summarize the main

[6]See, for instance, Berry and Cline [10] and the International Labour Office [11].

[7]A series of flow charts and the complete system of equations are given in a UNIDO oer [12].

behaviour relations of the model and the extensive collection and processin work involved in estimating them. The comparative advantage of the UNITA team was, indeed, its access to the whole United Nations information syste and a systematic attempt was made to measure the effect of structural ar institutional changes by econometric relations. The following indications ref to developed and developing market economies, while the main relations to th model for centrally planned economies are illustrated immediately thereafter.

Production relations are described by regional eight-by-eight input-outp matrices linking output and final demand. In the value-added quadrant, instea of using fixed capital and labour coefficients, the model allows for substitutic between labour and capital by means of a labour productivity function, th main arguments of which are capital per worker, a value-added coefficier embodying the output mix within the sector, and technical progress. Note th this labour productivity relation can be derived analytically from the family the Cobb-Douglas production functions. As mentioned earlier, the productivit functions are applied to 12 "utilizing" sectors (instead of 8), since the energ and basic products sectors have been broken down into five subsectors. Th agricultural labour productivity function in developing countries is compute separately for small, medium-sized and large farms, to which percentage shar of farmable land are allocated exogenously. The arguments of such functior are the ratio of land to labour, cropping intensity, the ratio of capital to work and material input per worker. The values of the arguments vary according the size of the farm.

A major effort in the area of data collection and analysis has bee necessary to derive the 11 eight-by-eight input-output regional matrices, estimate the parameters of labour productivity functions and to measure th coefficients of agricultural labour productivity functions for farms of differe size. In particular, the regional input-output tables have been built ar projected on the basis of a collection of 49 original national tables, checked ar standardized by UNIDO. In addition, since the 49 available tables all refle technologies and output-mixes of the pre-oil-crisis period, UNIDO h undertaken a specific analysis of the effects of raising oil prices on input-outp coefficients for France, where long time series of detailed input structures a available, and for ECE countries over two periods.

It is clear that technology variables, including capital-labour ratios ar input coefficient matrices, should be used as policy variables to simulate t impact of different technologies on the world economy. In the present versio trend values have been computed, outside the model, for the five develope regions, while a more sophisticated treatment has been adopted for developir regions. In the two scenarios described in this article, the latter regions a expected to adopt progressively technologies from the North, without attemp ing to generate "appropriate" technologies. Yet the main component analys carried out on the 49 original country tables showed that vectors of inp coefficients, by sectors, tended to cluster for countries of the same region; th suggests that the "technologies" of each region, which at this level should interpreted as technology mixes of subsectors, have specific features attribu able to a host of institutional factors, that is, the distribution of enterprises size. In order to reconcile the concept of specific regional technologies with t progressive application of imported technologies, the projected input coefficie

ctors have been computed as a weighted average of base-year vectors and of rget vectors chosen from among developed regions. The weights, which are a nction of exogenous values of capital intensiveness, can then ensure economic nsistency between the input-output matrices and the productivity functions.

The productivity relations in industry have been analysed on the basis of ta provided by the United Nations Secretariat in the *Yearbook of Industrial atistics* from annual surveys conducted at the enterprise level, a source so far explored. These data were processed for a sample of 33 countries for the ars 1967-1976; 55 indicators derived from the original data were computed r 40 ISIC three-digit sectors separately for each country.

Similarly, for developing countries the agricultural productivity functions ve been estimated on the basis of information provided by the Farm anagement and Production Economics Service of FAO for samples of several ousands of farms of different size, covering 18 developing countries. For each rm it was possible to derive 17 original indicators measuring land, labour, pital and material input and cropping intensity by farm size, as well as tput, yields and output per worker.

Households allocate their disposable income between savings and eight ivate consumption categories. Total private consumption is a function of net sposable income *per capita* and population, while its structure by object pends on average *per capita* consumption and on the relative prices of the ght consumption categories. For the developing regions, total private nsumption, as well as private consumption by object, have been estimated parately for the rural and the urban sectors. The data base used for imating econometrically both the aggregate consumption function and the gel curves includes the information provided by the United Nations cretariat in the *Yearbook of National Accounts Statistics* (for the developed gions) and by ILO in *Household Income and Expenditure Statistics,* covering large developing countries. Government consumption is a function of vernment disposable income, while its structure is assumed exogenously. tal gross domestic savings are obtained by adding up the savings of useholds, government savings and the gross (of depreciation) disposable come of enterprises.

For a given output mix, endogenously determined by the input-output ations, investment requirements by producing sector are derived from oductivity functions and technology parameters such as capital-labour ratios d depreciation rates. Therefore, investment is basically allocated according to mand rather than on the basis of some type of profit-maximization echanism. For the developing countries, investment in agriculture includes e capital expenditure needed for land extension and increased cropping tensity. The information used for building these relations has been obtained om the United Nations *Yearbook of Industrial Statistics* and from the FAO oject "Agriculture: towards 2000".

Trade has received an elaborate treatment. As mentioned earlier, imports eight groups of goods and services are computed within each regional model the basis of econometrically estimated import functions. The main guments of the latter are an activity variable (generally the domestic oduction of one or more industrial sectors); the ratio of domestic to import

prices; and two policy variables, namely, the level of protection (tariff and no tariff) and the average domestic market size, that is, an indicator measuring tl degree of economic co-operation among neighbouring countries and/or tl effect of the enlargement of the domestic market as a result of the grow process or of income redistribution policies. The activity variable is expected measure complementary imports, while the other three tend to decrease the level through import substitution. In particular, the domestic market size instrumental in determining the level of imports and, via the input-outpu framework, in allocating final demand between domestic supply and import This curbs the growth of the basic products and of the capital goods sectors i regions with a small industrial base and introduces a means of measuring th long-term impact of economic groupings which affect the domestic size of th market. The functions have been estimated from both time-series and cros sectional data provided by trade tapes of the Statistical Office of the Unite Nations Secretariat. Extensive data on protection levels were also derived fro UNCTAD and GATT sources.

As already mentioned, exports are generated by the trade module, which made up of seven 11-by-11 trade share matrices (for goods) and by one poo (for services). The generation of the export vector, therefore, depends criticall on the projections of such trade-share matrices. To endogenize these matrice two different procedures were applied, the gravitational and the sem aggregated models. According to the first, any bilateral flow, for a specifi commodity group, depends on the total imports (all origins) of the importin region, on the total exports of the exporting region, and on "economi distance" estimated by the gravitational model itself, which is influenced b transport costs, and institutional and sectoral conditions. The semi-aggregate model, on the other hand, is an extension of Stone's linear expenditure systen used in projecting private consumption. Its explanatory variables are the tot imports of the importing countries and the relative price indices (here in un values) of imported goods. In the present version, trade shares are used exogenous parameters. Their projection for the horizon year has been derive from three sources outside the system:

(a) For some regions, particularly the centrally planned economy region the trade shares deviate considerably from their trends—they have bee determined so as to reflect policy statements published in these two regions an should therefore be interpreted as policy variables;

(b) For primary commodities, the trend given by the semi-aggregate model has generally been followed, with the exception of trade shares in th energy sector, which have been endogenized in one scenario, so as to brin about a production level equal to a predetermined maximum productio capacity in all market economies except those of West Asia, the export flov of the latter region therefore being a residual (see chapter II, section B, below)

(c) For manufactures (intermediary products), consumer non-durable equipment, and consumer durables), the estimates obtained by the gravitation model have been taken as a basis, with controls to restrict the magnitude of th changes to a ceiling that is a decreasing function of the share in the base yea This treatment is meant to reflect the crucial influence of the dynamics supply on the long-term competition between different exporters, as can t

bserved, for example, in the development of exports of manufactures of East sia and Japan during the observation period. For each region the difference etween total imports and total exports determines the trade gap.

Labour demand, supply and unemployment are generated in the demo- raphic labour-market block of the system. Labour demand by production ector is obtained by dividing sectoral value added by the corresponding labour roductivity, while total labour demand is obtained by adding through sectors. abour supply is obtained by multiplying the male and female working age opulation at the target year (obtained from the United Nations paper Selected world demographic indicators by countries, 1950-2000" (ST/ESA/ ER.R.38)) for their corresponding participation rates, which have been rojected outside the model on the basis of the ILO population and labour orce projections, 1975-2000 and the United Nations work just cited. Inemployment is obtained as a difference between labour demand and supply. Iote that for the developing countries, labour demand, supply and unemploy- ient are computed separately for the urban and the rural sectors.

Land demand, supply and land gap are computed for the developing egions only. Land demand depends on the exogenously projected ratios of ind to labour of each class of farms, on land distribution among small, iedium-sized and large farms, and on the desired level of agricultural output. and supply is projected exogenously on the basis of figures obtained from ie FAO project "Agriculture: towards 2000", which include feasible land xtension. Land gap is the difference between supply and demand.

The regional model for the centrally planned economies of Europe shares everal features and relations with the models for the market economies. It iows, however, some differences. For example, all aggregates are expressed in erms of net material product (NMP); the model is computed almost exclusively constant prices, the only equations in value terms being those linking the egion to the world economy; a major feature of the Eastern European model is iat full employment is always assured through a trade-off (computed by the iodel) between new technology, reflecting desired ratios of capital to labour, nd old technology, which is more labour-intensive. The rate of withdrawal of ld technology is thus endogenously determined in the model as a compromise etween decisions to introduce modern technology with a priority ranking of ectors, and the need to achieve full employment. As a consequence, the verage labour productivity determined by the model lies between the lower mit set by the old technology and the upper limit set by the new technology. his holds true for six "industrial" sectors (agri-food processing, oil refineries nd coal products, primary processing of basic products, light industry, capital oods industry and construction), for which two different specifications for the ld and the new technologies are included. For the remaining sectors, an verage productivity function has been estimated on the basis of time-series ata.

To end this description of the UNITAD system, a few indications may be iven of its functioning. The model is solved by iteration. The values of the ase-year conditions, the regional GDP growth rates and the initial values of ie value-added share vector (which becomes endogenous once convergence has een reached) are fed into the system, which generates all final demand omponents through its parametric structure and the exogenous assumption.

The aggregate final demand generated at the end of the first iteration does not need to be equal to GDP; hence, in order to ensure consistency, the system adjusts the former through a loop affecting the wage and non-wage shares of value added, which, in turn, determine a new final demand vector. Through the Leontief inverse matrix, the latter generates a new value-added share vector which is used for the next regional iteration. When all regional models have converged, an interregional loop generates new export values and new factor payments for each regional model, and a new set of regional iterations begins. Three interregional iterations and three-by-five regional iterations for each regional model are generally sufficient to yield consistent solutions at the regional and interregional level. The system can therefore be said to be fairly stable, in spite of its non-linear character, and to converge rapidly. Two flow charts (figures I and II) illustrate the main interrelations mentioned in this paragraph.

At the present stage, however, a number of trial runs of the system are needed in order to generate a meaningful projection and to familiarize the users with the system's response. This cumbersome procedure is necessary because there is no systematic feedback of the values of the gaps generated by one run to the exogenous variables embodied in the assumptions. The model has therefore been used, so far, as a man-machine system, in the sense that the feasibility and plausibility of the gaps must be assessed for each run by the user of the model. New exogenous variables are then fed into the system and a new run made to test the resulting new gaps.

At the present juncture, sensitivity tests are being systematically carried out to shorten the process of adjustment. In the near future, it is envisaged that the completed system will generate the values of the technology variables and trade variables (protection and share variables) in line with given growth and trade-gap targets.

Figure I. Flow chart for the global model

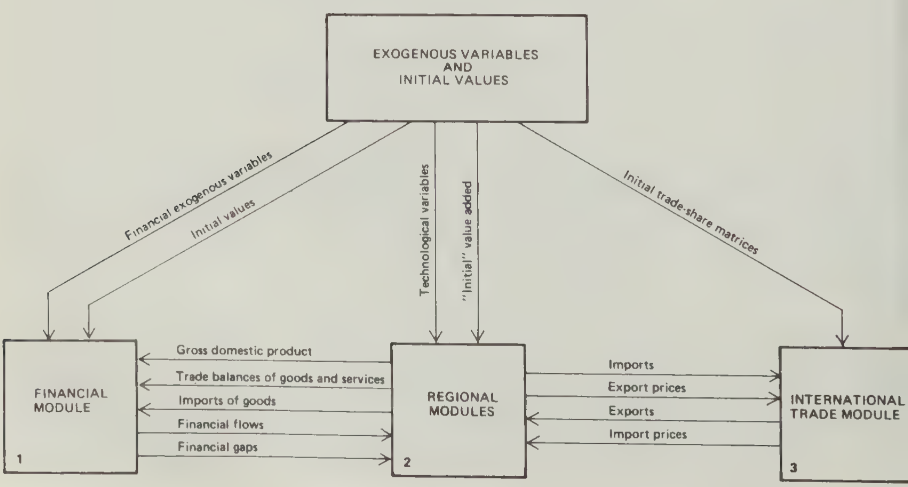
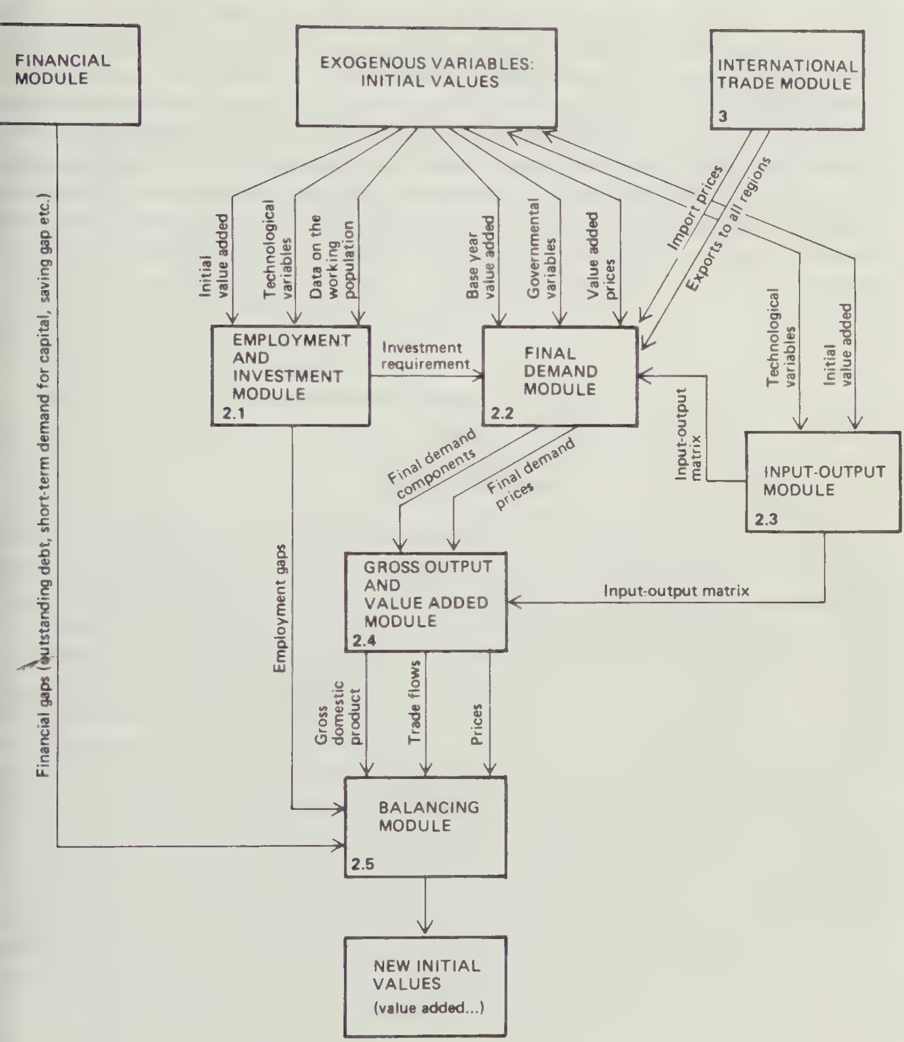


Figure II. Flow chart for the regional model



II. Policy applications of the model

The model structure described in chapter I above and the annex below has ·en used to evaluate the picture of the world economy in 1990, as well as to sess a range of future regional developments that would be consistent with ‧o alternative sets of exogenous assumptions, broadly identified as a "trend" enario and a scenario for the Third United Nations Development Decade. It ould be clear from the outset that the results emanating from such an exercise ould be interpreted with extreme caution. Most certainly they must not be

identified as forecasts, even of a very broad nature. They are essentiall conditional projections, providing a set of consistent results for the target year given the projected values of the exogenous variables. Whether they ar optimistic or pessimistic, plausible or implausible, desirable or undesirable will largely depend on the accuracy of the exogenous predictions, as well as on the specification of the model itself. If, for instance, the gaps resulting from the assumptions are beyond any realistic magnitude, the initial assumptions can and should be changed to explore alternative futures. The interest of the mode should therefore be evaluated on the basis of its capacity to explore the response to alternative sets of asumptions and not on the basis of a single scenario.

A. The trend scenario

Basic assumptions

The title of this scenario refers to trends observed in the past, but this requires clarification. The general orientation has been to take expected trends, as they are perceived today, rather than those observed over the last 15 years. As far as the international environment is concerned, both a continuation of present financing and monetary practices and moderately free trade policies are assumed. Commercial loans and direct investment continue to grow at currently observed rates (12 per cent a year) and to be distributed geographically as at present, that is, with a few developing countries absorbing an extremely large proportion of total lending. Lending conditions (interest rate and maturity) continue to be unfavourable for borrowers. Poorer countries continue to be dependent on ODA from donor countries at a level that is expected to increase only marginally from the current figure of about 0.35 per cent of the GNP of the donor country. The values attributed to the trade share matrices and to the dummy variables for protectionism feature a situation in which no further commercial integration is assumed either in the North or in the South. No further protection is simulated in the North-South trade on either side, while the relative international prices of energy and agricultural products are assumed to be 2.6 and 1.3 times higher in 1990 than in 1970.

At the domestic level, regional GNP is assumed to continue to grow at differentiated rates. The over-all rate for the North (about 3 per cent) over the period 1975-1990 reflects current expectations, taking into account the modest performances recorded between 1975 and 1980. For the developing world growth rates of about 3.5 per cent are tested for Tropical Africa and South Asia, while Latin America, West Asia and East Asia are assigned rates of approximately 6 per cent. In the area of technology, the choice of techniques in agriculture, industry and services is expected to reflect the continued transfer and adoption of capital and input-intensive technologies developed in the North. No institutional changes are assumed in the domestic distribution of assets and income, nor is any alteration foreseen in the level of taxation and in the structure of government expenditure.

Over-all assessment of the trend scenario

The picture of the world economy that emerges for 1990 on the basis of revious assumptions is not very encouraging. At the international level, it eems to be dominated by the persistence of large payment imbalances, eflecting consistent resource gaps, to finance GNP growth rates that are less uoyant than in the past. As can be seen from the table, the imbalances are articularly severe for Latin America and East Asia, while West Asia and the ther developed countries enjoy comfortable surpluses. Trade is almost in quilibrium for Western Europe, Japan and the two regions with centrally lanned economy and, to a lesser extent, for North and Latin America. West sia and the other developed countries enjoy large surpluses, while all other eveloping regions are faced with large trade deficits, ranging from 5 per cent 7 per cent of their GNP.

When factor payments from and to abroad and ODA are taken into onsideration, the over-all picture appears substantially improved for North merica, which, thanks to a hefty inflow of interests and profits, will move om a deficit of over 1 per cent of its GNP to a small surplus. Other dustrialized regions do not show any noticeable changes. Tropical Africa and outh Asia show an over-all improvement in their current foreign accounts ecause of large inflows of ODA and, in the case of South Asia, substantial emittances by migrants. The position of the current balance is much worse for ast Asia and, especially, Latin America. There, interest payments on foreign ong-term outstanding debt will absorb almost 8 per cent of GNP (about 2 per ent in 1977), showing that there is a pressing need for these regions to control ne growth of their foreign debt.

In the model, surpluses are assumed to be recycled as short-term capital ovement. In practice, however, recycling of this order of magnitude has little nance of occurring under present conditions. Indeed, an examination of the osition of the basic balance (current balance plus inflows and outflows of ong-term capital) shows a substantial equilibrium for all regions except Latin merica and East Asia, which could require large amounts of balance-of-ayment financing, in addition to the already large borrowing of long-term apital. For these two regions, a growth rate of output of 6 per cent is clearly naffordable under the assumptions made in this scenario.

It should be noted that, under this scenario, all the developing regions will ave long-term outstanding debts of colossal dimensions in 1990. In East Asia, ie outstanding debt will be equivalent to 64 per cent of current GNP (30 per ent in 1975). Similarly, Latin America, South Asia and Tropical Africa will ce outstanding debts of between 32 per cent and 60 per cent of their GNP. ven more disturbing is the fact that, in 1990, interest payments on current utstanding debt will be as large as the current-account deficits of all eveloping regions (West Asia excluded). Similarly, interest payments from eveloping countries will absorb 75 per cent of their total export earnings of gricultural products and raw materials (energy excluded). Clearly, a policy of eavy indebtedness cannot be sustained in the long run under the conditions at resent regulating world trade and finance.

In almost all developing and several developed regions, rising unemploy-ent and a probable worsening of domestic income distribution prevail in this

Trend scenario to 1990: main assumptions and outcome, by region

Characteristics of the scenario	Developed countries					Developing countries					
	North America	*Western Europe*	*Centrally planned economies of Europe*	*Japan*	*Other developed countries*	*Latin America*	*Tropical Africa*	*West Asia*	*South Asia*	*East Asia*	*Centrally planned economies of Asia*
						Assumptions					
Growth rate of GNP (percentage)	2.6	3.0	4.0	4.9	3.5	5.5	3.7	5.9	3.5	6.0	6.0
World trade											
Protectionism	Continuation of past policies in all regions										
Oil and agricultural food prices	Oil 2.6 times higher in 1990 than in 1970, agricultural food 1.3 times higher										
Geographical distribution	Same commercial strategies for each region as in the base year										
Capital movements											
ODA (percentage of GNP)	0.3	0.45	0.1	0.3	0.7			2.0			
Commercial flows (billions of dollars)	−154	−38	13	−28	3	154	13	−36	15	47	11
Technology											
Input/output tables Ratio of capital to labour	Increasingly capital-intensive techniques with some energy conservation					Progressive adoption of Northern technology					

Balance of goods and services	−70	−50	11	1	22	−19	−13	173	−18	−28	
Current balance	15	−59	2	11	15	−117	−4	196	−8	−57	−4
Basic balance	14	−105	4	−6	15	−60	1	174	2	−39	−1
Outstanding debts	800	203	−73	147	−33	−757	−93	199	−127	−267	−45
Total unemployment (millions of persons)	16	12		9	6	75	89	17	234	85	
Urban						59	30	4	74	27	
Rural						16	59	13	160	58	
Land gap (millions of hectares)						+41	+4	+2	+11	+13	
Accumulation investment rate at current prices (percentage)	17.4	23.7	35.0	34.8	24.4	25.8	22.7	21.6	18.2	29.8	
Per capita GNP at 1970 prices (dollars)	6 510	3 210		4 180	2 170	1 001	165	610	139	444	
Growth rate of *per capita* GNP (percentage)	1.7	2.5		4.3	2.4	2.8	0.6	2.9	1.1	3.7	
Growth rate of *per capita* consumption (percentage)	1.1	1.9		4.0	0.3	2.1	0.9	3.2	1.0	2.5	

scenario. Indeed, with the present growth rates of output, the adoption o increasingly capital-intensive and input-intensive techniques and the lack o land redistribution measures, together with substantial increases in the size o the working-age population, it appears that at times only half of the labou force will be productively employed. As already anticipated in numerous othe reports, the occupational situation is expected to be particularly grave for th developing world. In 1990, it seems that only West Asia will experienc acceptable unemployment levels in both the rural and the urban sectors. Rura Latin America will probably achieve full employment conditions, owing to a very fast rate of urbanization. There, the unemployment problem has been transferred to the urban areas. In South and East Asia, as well as in Tropica Africa the unemployment problem will apparently become intractable. In South Asia, for instance, over 160 million people in the rural areas alone will b without a job in 1990, whereas about 75 million people will be jobless in th towns. Similarly, in South-East Asia and Tropical Africa, respectively, 85 an 89 million people will be unemployed. These figures, although highly tentative are unacceptable even by the standards of developing countries. Furthermore in South Asia and Tropical Africa, a low growth rate of income *per capita* (1. and 0.6 per cent per annum), together with rapidly rising unemployment an underemployment, will necessarily result in an increased marginalization of th weaker socio-economic groups, which, in the probable absence of welfare-typ income transfers, would see their income and consumption fall in relative and perhaps, absolute terms.

Occupational prospects do not look bright in the industrialized worl either. There, the growth of employment opportunities would appear to b moderate in comparison with the growth of the labour force. Contained growt rates of output only partially explain such phenomena, which should, amon others, be attributed to the autonomous growth of labour productivity resultin from continued innovation and the adoption of increasingly capital-intensiv techniques. If no changes in the organization of production are envisaged, b 1990 all the industrialized economies will experience higher unemploymen levels than at present. The figures shown in the table, however, do not take int consideration a possible reduction of the work-week and the introduction o part-time jobs. These adjustments might considerably ease the situation in th labour markets of the more advanced economies.

With no more major changes in the structure of land ownership, and wit the adoption in agriculture of tendentially more capital-intensive and input intensive techniques, the model generates, in addition to catastrophic unemploy ment rates, incomplete utilization of the land that could be cleared and put t cultivation. This seems to be the case in Latin America and Tropical Africa where a substantial amount of potentially arable land will remain idle.

Unbalanced growth appears to be a third main feature of the tren scenario to 1990. Over-all investment rates will increase only marginally b 1990 compared with the base year. Still, with the economy of several region growing at moderate rates, if capital intensiveness of production were to remai constant, one would expect slightly declining investment rates, owing to th functioning of the accelerator mechanism. This is not the case, however, fo most of the regions being analysed. As will be seen in the analysis of industr and trade, an increased and rapid capitalization of the economy entails a faste

an average growth of the sectors producing capital goods and intermediate oducts and a faster growth of these sectors vis-à-vis the sector producing sentials. This would appear to be the situation in 1990 in West, South and ast Asia. There, the growth of heavy industry and mechanical equipment ıtpaces the growth of light industry and the processed-food sector, as well as e growth of agriculture.

With slow growth in the North, very little in the way of optimistic pectations for ODA and no fundamental changes in domestic policies, the veloping countries—and especially the poorer ones—would thus face little ıprovement in living conditions, unbalanced growth, intolerable unemploy-ent levels and a probable polarization of the domestic distribution of income ıd consumption. To conclude, a scenario of this type would appear to offer tle prospect for reducing poverty in the third world, or for sustaining the owth of world GNP.

Industry and trade

A few interesting indications emerge from the analysis of the scenario as r as the sectoral and geographical composition of production and trade are ncerned. As expected, the agricultural value added share in developing untries continues to decline (15.5 per cent in 1990 as against 21.8 per cent in e base year). This is partly due to the exogenous constraints put on the owth of agriculture for such countries, as well as to the technical relations of oduction that have been assumed. The growth of manufacturing is definitely ster (about 6 per cent a year for the group as a whole). Basic products and pital goods industries would absorb the lion's share of these increases as a nsequence of the assumptions made about the adoption of increasingly pital-intensive and input-intensive technology. It is also interesting to note at a very high proportion of the output of these two sectors is absorbed by e industry itself, either as intermediary consumption or as fixed capital rmation. The positive aspects of a process of this type is that technological perience quickly accumulates. The negative aspect of an industrial strategy of is type is that growth in the capital goods and basic product sectors is otained at the expense of consumption goods industries and agriculture.

The geographical distribution of manufacturing shows an improvement for e South as a whole, which in 1990 would account for a 12 per cent share of orld production (8.7 per cent in 1975). This increase does not, however, seem g enough to achieve the Lima target.[8]

A comparison of the developing regions seems to indicate that Latin merica will continue to retain more than half of the manufacturing activities the developing countries. A slowly declining share is observed for South sia, while the opposite holds true for West and South-East Asia.

As far as world trade is concerned, the share of developing countries will ach 9.8 per cent at the target year, compared with 7.3 per cent at the base ar. Total exports of developing countries will therefore grow at a real rate of

[8]This is in terms of 1970 dollars. If, however, 1975 dollars are adopted—1975 being the year the Lima target—then their share in 1975 was about 10.3 per cent, with a corresponding increase 1990.

7.7 per cent per annum. This over-all figure, however, conceals great variation from region to region. Latin America and East Asia, for instance, sho significant differences in their export performances. In 1990, the former woul appear to have a strong hold on the export markets of developing countrie (where it will unload 43 per cent of its total exports), especially in the case o capital goods and consumer non-durables. Its over-all exports to the develope and developing economies will grow at 8.7 per cent and 9.3 per cent a yea respectively. East Asian countries, on the other hand, show a much highe trade integration with the economies of Western Europe and North America, t which they export a large proportion of their manufactured goods and fro which they import primary goods. Although the export shares of East Asia o these markets are expected to increase, this would leave the region with larg trade deficits, because of the over-all slow growth of such markets and becaus of the faster increase in the prices of primary commodities vis-à-vis those o manufactures. In this case, therefore, the very high dependence of the deve oped economies on their export markets would appear to backfire.

The scenario also provides some interesting insights into the degree o dependence on manufacturing imports in the developing regions, as measure by the ratio of value added to total supply (value added plus imports). For th capital goods sector, the value of the ratio is increasing for all developin regions, and especially in South Asia; this clearly can be interpreted in terms o the reduction of technological dependence. The same holds true for the primar processing industries, while in the light industry sector trade dependence woul increase, which again is indicative of the low priority given in this scenario t the development of consumption goods industries.

B. Scenario based on the International Development Strategy for the Third United Nations Development Decade

Basic assumptions

This scenario is essentially meant to test the consistency of quantitativ targets and statements included in the text of the International Developme Strategy for the Third United Nations Development Decade, which wa adopted by the General Assembly at its thirty-fifth session (see Gener Assembly resolution 35/56). The Strategy addresses itself to a number o international and domestic issues and policies, leaving it to Governments an international institutions to achieve a balance between many, possib conflicting, orientations. The assumptions made in the scenario, as derive from the Strategy, are summarized below.

First, a key assumption refers to the growth rates of developing countrie the main orientation of the Strategy being to achieve in the 1980s a sustaine 7 per cent growth rate for developing regions as a whole. Thus, the annu GNP growth targets for 1980-1990 are expected to reach 7 per cent for Lati America, 5.5 per cent for Tropical Africa, 9.3 per cent for West Asia, 5.6 pe cent for South Asia, 6.8 per cent for East Asia and 6 per cent for the central planned economies of Asia. Developed market economies are expected to gro at an average rate of 3.3 per cent, very close to the rates tested in the tren

enario, as against 4 per cent for the centrally planned economies of Europe, us yielding an over-all 3.5 per cent growth rate for the North as a whole.

Secondly, since the scenario is meant to illustrate favourable conditions for e growth of the South, optimistic assumptions are made regarding trade and nancial structures: ODA is regulated by the 0.7 per cent of GNP rule for the veloped market economies, and has been taken as 0.5 per cent of gross aterial product (GMP) for the centrally planned economies of Europe, as well 2.5 per cent of GNP for West Asia. The annual rate of growth of non-ncessional capital flows is 12.5 per cent per annum, as in the trend scenario, it on much softer terms and conditions. On the trade side, no further otectionism is assumed, in spite of a further penetration of 10-20 per cent of e exports of manufactures from developing regions into developed markets, suggested by the gravitational model.

A third major assumption refers to the energy price index, which is set at a uch higher level than in the trend scenario: 3.8 times the 1970 real price, iich means an annual increase of from 2 to 2.5 per cent per annum in real ices during the Decade.

Lastly, agricultural growth rates, as suggested by the International evelopment Strategy, are tuned to a growth rate of approximately 4 per cent, an average for all developing regions, during the Decade (5.1 per cent for itin America, 2.9 per cent for Tropical Africa, 4.6 per cent for West Asia, 9 per cent for South Asia and 4.3 per cent for East Asia).

The energy balance

Special attention is given to the recommendations on energy conservation d the development of energy resources included in the International evelopment Strategy. Cuts in energy input in developed countries are pected to reach levels derived from a study by the International Institute of oplied Systems Analysis for the market economies and from a study by the onomic Commission for Europe (ECE) for the centrally planned economies Europe. Next, the 1990 supply capacity of the energy sector, subdivided into e four subsectors already mentioned, has been computed outside the model for ch region from an ECE study (at levels very close to those assumed in World ink studies). In order to make the endogenous energy production of the odel smaller than or equal to this maximum capacity, the trade shares for the ergy sectors and the coefficients of energy import equations have been rametrized. In this way, in all regions except three, energy imports are equal the difference between demand requirements and the maximum supply pacity. Besides the centrally planned economies of Asia, the exceptions are e two main oil-producing regions: the centrally planned economies of irope, where the energy output happens to be below the maximum capacity, d West Asia, where the output level is fixed endogenously to generate exports mmensurate with the requirements of oil-importing regions.

An examination of the over-all world energy balance, on the basis of the sumptions that have been made, leads to the following conclusions.

First, the required energy output for West Asia (which can be translated in ms of oil and gas) exceeds the capacity of the region (1.6 billion tons of oil

equivalent) by 18-65 per cent, depending on that trade share of the central planned economies of Europe. This excess can be reduced to 10 per cent if th primary sources of electricity (hydro power and nuclear electricity together) ar revised upwards according to the latest estimates in the three major oi importing regions (North America, Western Europe and Japan). Altogethe the model conveys the impression that a 7 per cent growth rate for developin regions would generate conflicting claims for scarce oil and gas resources unde the best assumptions made for energy conservation in the North.

Secondly, the resulting tension on the oil and gas markets could only b eased if the expansion of coal and primary sources of electricity in the Nort during the Decade were to go beyond the requirements recently estimated b the Governments concerned, so as to release additional oil and gas supplies fo the South. Alternatively, industrialized countries might finance new energ sources, including oil exploration, in developing countries. This woul obviously call for unprecedented negotiation at the world level, based on tw policy principles: a consensus to guarantee sufficient oil and gas resources fo the growth of the South and a long-term planning of energy resources for th world at large.

Thirdly, the scenario can also be interpreted as an indication of the trad reorientation needed to achieve a better energy balance in the future: a increase in intra-energy trade within the centrally planned economies c Europe; the same within North America; a substantial decrease in the We Asian share (oil) in the imports of Western Europe and Japan; and an increas in the shares of the centrally planned economies of Europe (coal, gas), Nort America (coal) and the other developed countries (coal, gas) in the imports c Western Europe and Japan.

An over-all appraisal of the scenario based on the International Development Strategy for the Third United Nations Development Decade

The pre-eminence of the energy problem in the North also extends to i financial aspects. First, it can be traced to the consistent negative balances c goods and services of the order of 1.5-2.5 per cent of the GNP in current pric found for North America, Western Europe and Japan. In contrast, the energ endowment of the centrally planned economies of Europe and the oth developed countries yield positive balances for both regions.

In the developing regions, the energy situation appears at first glance to b more balanced. Latin America, Tropical Africa and East Asia (which includ Indonesia) exhibit modest surpluses in energy trade, while South Asia has a n deficit of about 12 per cent of total imports. This, together with the larg surpluses of West Asia, merely reflects the geographical distribution of o deposits, which happen to be liberally located in the South. This apparentl optimistic picture, however, conceals the difficult situation of the oil importer and particularly the majority of the Latin American, Tropical African and Ea Asian countries. In general, the reassuring regional balances illustrate th benefits to be derived from a policy of South-South solidarity between oi importing and oil-exporting countries, but this would call for an entire different policy orientation from the North-South linkage embodied in th scenario.

The relatively neutral energy effect on regional balances makes the large rrent payment gaps found in the South all the more conspicuous: as a rcentage of GNP, the current payment gaps (before adding on ODA) reach 3 per cent for Latin America, 14.2 per cent for Tropical Africa, 4.3 per cent r South Asia and as much as 9.9 per cent for East Asia, while for West Asia e surplus amounts to 17.2 per cent of GNP. If interpreted in terms of savings-vestment gaps, these figures can be related to the high investment ratios, in ation to GNP, found in the scenario: 31.2 per cent for Latin America; 44.7 r cent for Tropical Africa (nearly one half for agriculture alone); 25.4 per nt for West Asia; 21.8 per cent for South Asia; and 36.3 per cent for East sia. The 28 per cent investment ratio recommended by the International evelopment Strategy appears to be more than achieved for the South as a nole (30 per cent in the scenario). Such high investment levels cannot be ached without additional payment facilities, and the scenario actually shows at the optimistic ODA allocation assumed by the Strategy can wipe out the rrent gaps in several regions, particularly if directed towards the development agriculture in Tropical Africa and South Asia.

Even accounting for ODA, huge current payment gaps emerge in Latin nerica (5.8 per cent of GNP) and East Asia (7.4 per cent of GNP). These are sentially due to the debt service, despite the improved terms of non-ncessional capital flows (real interest rate of 2-3 percentage points, maturities nging from 12 to 27 years). In both regions, a continuous growth of rrowing appears to be necessary in order to service the gigantic debt which eps on accumulating. This strengthens the conclusion already reached in the end scenario, namely, the absolute need for these two rapidly industrializing gions to keep the growth of their outstanding debt under control. It also casts rather pessimistic view on the possibility for these regions to achieve the owth targets of the International Development Strategy on the basis of orth-South linkages simulated here.

Yet the trade performances of developing regions are remarkably ccessful in this scenario. The growth of exports of manufactures reaches per cent per annum for the South, compared with 5.4 per cent for the North. e relative dependence of the South in the trade of manufactures can be ustrated by considering a North-South trade matrix and dividing the exports developing regions to the North by their imports from the North. A ratio of o 5 was observed in 1975, as against a ratio of 1 to 3.2 in the trend scenario d a ratio of 1 to 2 in the International Development Strategy scenario. The uth-North trade dependence can be said to have been halved, but this lliant achievement, it should be observed, is obtained at the cost of a heavy ancial dependence and, last but not least, appears to be extremely vulnerable possible protectionistic responses of developed regions.

On the social side, the International Development Strategy scenario does t differ sharply from the trend scenario, in spite of the fact that some of the gets of the Strategy are met. To quote only employment figures, the growth industrial employment, encompassing the "modern" sectors, namely, nufacturing, mining and utilities, appears to be 2.7 per cent per annum, ghtly higher than the minimum rate of 2.5 per cent needed under the Strategy give jobs to new entrants. This rate, it is clear, is not high enough to absorb unemployment already existing in the base year, so that unemployment in

that sector remains at a high level, while underemployment is likely to increa in the agricultural sector. Indeed, the high growth rates of output for t industrial sector in this scenario (6.3 per cent for the period 1975-1990) can taken as a starting point from which to reflect on the magnitude of t employment problem. Owing to the high productivity of this sector, and relatively low contribution to employment in the base year (6.5 per cent of t total active population, compared with 35-38 per cent in the develop regions), there is little hope at this juncture that an industrialization poli alone will have a massive impact on employment. In other words, techn logical policies in other sectors (agriculture, construction, services) are mu more likely to be instrumental in solving the employment problem in the ne 20 years as long as the industrial base is not built up. This is not to minimi the importance of appropriate technologies in the industrial sector, but th objective should not be detrimental to the progressive achievement of integrated industrial network.

The real question, therefore, appears to revolve around the conditions f achieving a growth more commensurate with the ambitions of the authors the International Development Strategy. A capital-intensive agriculture of t type simulated in this scenario can only result in a world in which people live misery, while the international environment is seen to generate increas dependence. Other ways should therefore be explored, along the lines of t "unified approach to economic and social development" called for in t International Development Strategy (see General Assembly resolution 35/5 annex, paragraph 42).

A variant with low growth for the North

One of the inconsistencies found in the preceding analysis was t difficulty of achieving a plausible energy balance with a 7.0 per cent growth f the South coupled with a 3.5 per cent growth for the North. As was observe such growth rates were likely to generate a tight situation on the energy mark with a possible squeeze on the oil and gas supplies of developing countries. addition, large payment imbalances would be found in developed mark economies, about 2.5 per cent of current GNP for North America and Japa and 1.5 per cent for Western Europe. The implications of a growth rate for t North of 1.6 per cent, that is, one half of the preceding case (the bas International Development Strategy scenario) should therefore be explored.

The reaction of the UNITAD system is summarized below.

First, the world energy balance is much improved. The "energy" outp level for market economies as a whole is about 10 per cent below the le reached in the basic scenario but only a few percentage points below t expected full capacity in 1990. If the centrally planned economies are adde the downward move of the world's "desired" output of energy is 12 per cent f the North, and 4 per cent for the South.[9]

[9]This yields a relatively low elasticity figure for energy output as related to a 1 per c change in the growth rate for the North (0.7 for world output, 0.8 for output in the North and for output in the South).

Secondly, the trade balances of market economies improve for the three -importing regions (with slightly positive balances for Western Europe and ghtly negative balances for North America and 2 per cent of GNP for Japan). iere is a slightly negative effect on the balances for the other developed untries, though they are still positive. Eastern Europe loses two thirds of its t surplus and approaches equilibrium.

Thirdly, with respect to current balances, the same optimistic assumptions garding ODA and international loans that were made in the basic scenario store equilibrium in South Asia, as they did in the former scenario, but nerate a small deficit (−0.6 per cent of GNP) for the African region, Latin nerica and East Asia must now service not only their long-term debts but so their short-term balance financing, so that the Latin American current yment gap increases by 50 per cent and the East Asian gap triples.

This is enough to illustrate both the sensitiveness of the model and the iinful conclusions to be drawn from it. Developing countries just cannot stain the 7 per cent target of the International Development Strategy under e assumptions of the low-growth variant of the North. This is obvious for itin America and East Asia, but it may as well be extended to Tropical Africa d South Asia, since the doubling of the ODA required to make good their rrent gap is hardly plausible in a sluggish Northern economy. The South erefore appears extremely vulnerable to the growth of the North, with rhaps one qualification, in that South Asia appears less dependent because of relatively low participation in world trade and its low level of indebtedness.

A comparison of the results of the two International Development rategy scenarios shows that the developing regions are apparently squeezed tween a high growth rate for the North, which generates unbearable tensions the energy market, and a low-growth alternative, in which their export rnings are shrinking. The only way out, therefore, seems to be a growth ocess that is much less dependent on the world market; this obviously calls r a strong reorientation of trade and finance among the developing countries. scenario for economic development among developing countries is therefore sential to complete the picture of the International Development Strategy ready given here, since the North-South linkage along free-trade lines that has en simulated so far seems to end in a deadlock for the present decade.

III. Conclusions and indication for further work

In the preceding two chapters, an attempt has been made to convey a first ea of the model and its scope for policy application. Given the obvious limits space, both the description of the model and the results of the two scenarios ve been kept to a strict minimum, while reference has been made to the evant literature. However condensed previous discussion may have been, it ould be sufficient to illustrate the merits and the limitations of such an ercise.

The project was reviewed and evaluated by an international forum of perts, convened by UNIDO in June 1981 on behalf of the sponsoring encies, and some of their conclusions are of general interest.

In general, for example, it was acknowledged by the group of experts th the UNITAD system was an efficient tool for exploring institutional an structural transformations associated with the new international econom order and alternative development strategies. Comments were made on t nature and role of prices, the equilibrium mechanisms between the saving investment and payment gaps, the treatment of technology and the impo functions.

The time treatment in the economic dynamics of the system was criticize and it was recommended that more flexible time paths should be introduced the equations involving stocks (essentially physical capital and financial capit flows), instead of the linear or exponential trends assumed so far.

Another criticism referred to the operation of the model as a man-machin system, with GDP fixed as a target. As shown in chapter I above, th manipulation of the system was admittedly a cumbersome procedure, whic should be simplified and made more flexible. In particular, the exper recommended that the system should be completed so as to generate a growt rate, given the trade gap, or to generate the technology and trade paramete compatible with given growth rates and trade gaps.

Additional issues were suggested by some experts for future consideratio in particular the economic influence of transnational corporations (in so far this can be done in a macro-economic model), the impact of disarmame policies and the environmental implications of new world industrial structures.

The sponsoring agencies, on the other hand, had in mind the exploratio of a spectrum of issues within the system as it stood. A UNIDO project alon those lines, it was noted, was actually under way. It included, essentially, tw broad themes: economic co-operation among developing countries; and growth process oriented more towards the internal market, with appropria technologies in some sectors.

The system might then be used to explore conditions for a sustaine growth of the South by any combination of those policies; a variety scenarios might be generated, depending on the assumptions made regardin future trends in the developed countries and the decisions of the worl community on the international environment. In that respect, leaving aside continuation of the current trends, which, it was seen, would be conducive t increased misery and inequity and would seriously affect low-income region the following two main families of assumptions would be worth exploring:

(a) A progressive promotion of a new international division of labou implying a strong adjustment on the part of industrialized countries, and particular industrial redeployment, with a further liberalization of trade an adequate financial structures;

(b) A more imaginative world pattern, encouraging collective self-relian among developing countries and calling at the same time for a de restructuring of developed countries so as to reduce the waste of natur resources at the world level. Such an international order, more respectful alternative development strategies, could be combined, in some regions, wi internal policies along the lines of the "unified approach to economic a social development" suggested in paragraph 42 of the International Develo ment Strategy—in other words, oriented towards maximum employment a active participation of the whole population.

Lastly, the system could also be used to explore the future development of ne specific region, in co-operation with the regional and subregional economic ganizations concerned. In that case, the information supplied by the system n the world environment and the linkage between that specific region and her regions should be matched with disaggregated studies or models, among bregions or countries, conducted by the regional organizations concerned. me projects of that type were actually suggested by the group of experts.

Annex

REAKDOWN OF THE TRADE, PRODUCTION AND CONSUMPTION SECTORS

ade	*Entries in the Standard International Trade Classification (SITC, Rev. 1)*[a]
ricultural products	Sections 0, 1, 2 (excluding groups 251 and 266 and divisions 27 and 28); section 4
n-agricultural raw materials	Divisions 27, 28 (excluding group 286)
ergy	Group 286; section 3; groups 515 and 688
termediate products	Groups 251, 266; section 5 (excluding group 515 and divisions 54 and 55); division 61; group 621; division 63; group 641; divisions 65, 66 (excluding groups 665 and 666); divisions 67, 68 (excluding group 688); groups 691, 692, 693, 694, 698; division 81
nsumer non-durables	Divisions 54, 55, 62 (excluding group 621); groups 642, 665, 666, 696; divisions 84, 85, 89 (excluding groups 891, 896 and 897)
uipment	Group 695; divisions 71, 72 (excluding groups 724 and 725); division 73; group 861
nsumer durables	Groups 667, 697, 724, 725; divisions 82, 83, 86 (excluding group 861); groups 891, 896, 897; section 9
oduction	*Entries in the International Standard Industrial Classification of All Economic Activities (ISIC)*[b]
riculture	Major division 1; group 3132
ricultural food processing	Major groups 311, 313, 314
ergy	Major groups 210, 220, 353, 354, 410, 420
sic products	Major groups 230, 290, 341, 351, 352, 361, 362, 369, 371, 372
ght industry	Major groups 321, 322, 323, 324, 331, 332, 342, 355, 356, 381
pital goods industry	Major groups 382, 383, 384, 385, 390
nstruction	Major division 5
rvices	Major divisions 6, 7, 8, 9

Private consumption[c]

Food, beverages, tobacco

Clothing and footwear

Gross rent, fuel and power

Furniture, furnishing and household equipment and operation

Medical care and health

Transport and communication

Recreation, entertainment, education and cultural services

Miscellaneous goods and services

[a]*Statistical Papers,* Series M, No. 34, Rev. 1 (United Nations publication, Sales No. 61.XVII.6).

[b]*Statistical Papers,* Series M, No. 4, Rev. 2 (United Nations publication, Sales No. 68.XVI.8).

[c]Categories defined by the Statistical Office of the United Nations Secretariat in its *Yearbook of Nationa Accounts Statistics.*

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nvestment planning and industrialization 1 the Syrian Arab Republic: simulation exercise*

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Introduction

Modelling the industrialization process for development necessitates a iodelling of the entire economy. The interrelations between the industrial ector and the other sectors of the economy are such that a study of the idustrial sector in isolation cannot be justified. In the case of the Syrian Arab epublic, there are in addition a number of distinguishing features that are nique to the macro economy and require special attention. Some of these istinguishing features are listed below.

First, the prevailing Keynesian model is uniquely tied to the circum- tances and conditions of developed industrial economies. It devotes a great deal f attention to aggregate demand and not enough attention to the conditions of upply. In the Syrian Arab Republic, production bottle-necks, deficient echnological conditions and shortages of skilled labour are critical variables iat qualify and define the production patterns and processes. Thus, Keynesian iacro models are of limited utility in explaining and predicting economic erformance in the Syrian Arab Republic. What is needed is a supply- etermined model that takes into account the special supply constraints of the yrian economy.

Secondly, the Syrian economy is dominated by the trade and service ectors, which have accounted for almost 50 per cent of GDP in the 1970s. This reponderance of services has contributed very little to exports and has ierefore aggravated the balance-of-payment difficulties of the economy.

Thirdly, despite phenomenal growth in aggregate investment and the high ver-all growth rates of real GDP in recent years (see table 1) the Syrian conomy has not yet shown visible evidence of structural change. In particular, ivestment in mining and manufacturing has largely failed to bring about erceptible changes in the share of these sectors in total GDP (see table 2). urthermore, average annual employment growth in mining and manu- icturing during the period 1970-1975 was lower than for any other sector (less ian 2.5 per cent) and the share of those sectors in total employment declined 1975 to 12.9 per cent from 13.6 per cent in 1970 (see table 3). In contrast,

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Table 1. Syrian Arab Republic: average annual growth rates of GDP, 1970-1977

(Percentage)

Basis	1970-1977	1970-1973	1973-1977	1977
Current prices	22.0	13.0	25.0	11.0
Constant (1970) prices	10.0	7.2	11.2	3.4

Table 2. Syrian Arab Republic, selected economic indicators, 1970-1977

Indicator	1970-1977	1971-1973	1974-1976	1977
		(Percentage)		
Sectoral shares of GDP at current prices:				
Agriculture	20.7	22.1	19.4	19.7
Mining and manufacturing	20.8	19.8	22.9	18.8
Construction	4.9	4.0	5.6	7.2
Transport	7.9	10.0	6.3	4.5
Trade and services	45.7	44.1	45.8	49.8
Expenditure shares of GDP at current prices:				
Government expenditure	19.7	19.3	20.2	20.4
Private consumption	66.0	66.5	65.3	62.3
Gross capital formation	24.1	18.2	27.6	39.5
Exports	23.0	21.9	25.5	21.9
Imports	32.8	25.9	38.6	44.1
Sectoral shares of gross domestic fixed investment at current prices:				
Agriculture	16.1	21.2	10.8	7.7
Mining and manufacturing	37.6	32.4	46.3	46.1
Transport and communication	12.2	10.5	11.5	15.9
Savings and investment shares of GDP:				
Domestic savings	14.3	14.2	14.5	17.3
Gross domestic fixed investment	24.1	18.2	27.6	39.5
Balance of resources	−9.8	−4.0	−13.1	−22.2
		(Millions of US dollars)		
Balance of payments:				
Commodity trade balance		−181	−596	−1 528
Services (net)		114	−115	136
Trade balance		−67	−711	−1 392
Transfers (net):				
Private		28	50	
Public		143	491	1 136
Current account balance		104	−170	−164
Capital flows (net):				
Long-term		40	87	313
Short-term		18	81	113
Errors and omissions		−44	−1	10
Allocations of special drawing rights		3		
Change in reserves (− = increase in reserves)		−121	3	−272

Source: "Survey of economic and social development in the ECWA region, 1970-1978" (E/ECWA/80).

Table 3. Syrian Arab Republic: sectoral employment, 1970-1975[a]

ector	1970	1971	1972	1973	1974	1975	Average annual employment growth rate, 1970-1975 (percentage)
	(thousands)						
griculture	737 (50.14)	892 (58.61)	902 (55.2)	850 (52.73)	864 (52.97)	895 (51.14)	3.96
ining and manufacturing	200 (13.61)	181 (11.89)	203 (12.43)	182 (11.29)	205 (12.57)	226 (12.92)	2.47
ransport	62 (4.22)	46 (3.02)	63 (3.86)	65 (4.03)	65 (3.99)	76 (4.34)	4.16
ervices	471 (32.03)	403 (26.48)	466 (28.52)	515 (31.95)	497 (30.47)	553 (31.60)	3.26

Source: Syrian Arab Republic, *Statistical Abstracts.*

[a]Numbers in parentheses are sectoral percentage shares of total employment.

griculture, which suffered a substantial reduction in its share of gross domestic xed investment (see table 2) from 21.2 per cent in 1971-1973 to 10.8 per cent in 974-1976, has borne the brunt of employment creation, expanding its nployment at an average annual rate of almost 4 per cent, and has supported ver 50 per cent of the total employment.

Fourthly, total real manufacturing value added (MVA) has increased at an verage annual rate of 7 per cent between 1963 and 1977. This rate, however, as slightly below the rate of growth of GDP. As a result, the ratio of MVA to DP declined in the 1970s. Furthermore, two manufacturing groups accounted r the major share of MVA. Food, beverages and tobacco and the textile, earing apparel and leather sectors produced more than 62 per cent of the total IVA in 1977. Textiles, wearing apparel and leather alone contributed 36 per ent, whereas food, beverages and tobacco contributed more than 26 per cent. extiles alone contributed over 30 per cent of the total MVA and about 84 per ent of the MVA within their division. The MVA growth trend of these two ctors has, however, fallen short of total MVA and thus their share of total IVA declined from 74 per cent in 1963 to 62 per cent in 1977. The major ecline has been in the share of food products, which fell from 39.4 per cent in 963 to 26.5 per cent in 1977.

Fifthly, the Government's budgetary deficits have grown at unprecedented tes, despite the growth of domestic revenues (see table 4). The areas of oncern relate to the possible fall of oil revenues, the abrupt drop of oil transit ues from the Iraq Petroleum Company, the deficient tax system and the ever-creasing food subsidies resulting from general inflation and increasing prices imported goods, especially foodstuffs.

Lastly, there is the problem of unstable capital inflows. These inflows creased rapidly after 1973 but fell drastically in 1978 and 1979.

These special problems and characteristics are likely to influence the ature and pattern of industrial growth in the Syrian Arab Republic. In articular, the Government would have to pay special attention to the

Table 4. Syrian Arab Republic: summary of public finances, 1970-1977
(Millions of Syrian pounds at 1970 prices)[a]

Item	1970	1971	1972	1973	1974	1975	1976	1977
Government revenues	1 698.8	1 525.8	1 579.9	1 539.9	2 511.2	3 117.7	3 055.7	2 892.
		(−10.18)	(3.55)	(−2.53)	(63.08)	(24.15)	(−1.99)	(−5.35
Government expenditure	1 187.0	1 329.5	1 552.6	1 827.8	2 414.3	2 534.0	2 784.2	2 858.
	(12.05)	(16.78)	(17.72)	(17.72)	(32.09)	(4.96)	(9.87)	(92.66
Government investment	647.0	754.1	707.2	700.7	1 141.1	1 583.3	1 615.8	2 203.
		(16.55)	(−6.22)	(−0.92)	(62.85)	(38.75)	(2.05)	(36.25
Government deficit	−135.2	−557.8	−679.9	−988.6	−1 044.2	−999.6	−1 344.3	−2 169.
		(312.57)	(21.89)	(45.50)	(5.62)	(−4.27)	(34.48)	(61.36
GDP deflator	100.0	104.9	114.2	118.6	157.1	180.2	195.6	210.
		(4.90)	(8.87)	(3.85)	(32.46)	(14.70)	(8.55)	(7.41

Source: Syrian Arab Republic, *Statistical Abstracts*.
[a]Numbers in parentheses are percentage changes over the year before.

commodity-producing sectors, promote exports, create additional jobs, contro the rampant inflation of the 1970s and restrict the growth of the government deficit. The industrial sector will feature prominently in such a strategy, as this article indicates.

The model[1]

A two-tier system is developed, whereby the macro-economic mode generates forecasts of the exogenous variables of the industry model. The macro-econometric model is a medium-sized disaggregative sectoral model which is dynamic, block-recursive and geared to handle alternative policy-oriented planning exercises. It consists of 78 equations, 30 of which are stochastic, the remainder being identities and definitional equations. The mode is organized into five basic blocks: production and expenditure, money marke and prices, labour market and employment, foreign trade and, finally, the balance of payments.

The salient feature of the model is the role assigned to investment as a major policy instrument. The model is basically driven by assigning specific values to sectoral investments, although it is amenable to other types o experiments through changes in other policy variables.

The macro model was estimated with annual observations covering the period 1960-1977. Since data were not available on a uniform basis for all the variables, shorter sample periods were used in a number of equations. The estimation relied primarily on Syrian sources, but data gaps were filled with secondary sources such as the World Bank and United Nations statistical series

[1]The equations of the macro model and the estimated equations of the industry model ar given in the annex.

nly ordinary least squares (OLS) were used, as the sample size was too small allow the use of more sophisticated methods.[2] Since the quality of the data as not high, analysis of the results was based not so much on the statistical gnificance of individual equations (for example, $\bar{R}^2$ and t tests) as on the rformance of the model as a whole in the simulation exercise.

The industry model consists of two stochastic equations and one finitional equation for each of the nine two-digit SIC classifications of anufacturing activity. The endogenous variables include the following:

D_i is the real domestic demand for manufacturing product i (apparent mand);

M_i is real imports of product i;

GO_i is real gross output of product i.

xogenous variables include GDP, domestic prices (P_i), import prices (P_{mi}) and ports (X_i).

The model is recursive: first, the demand is determined, then imports, hich, together with exports, determine gross output. Only OLS were used in oth linear and log-linear form.

The structure of the industry model (for a given year t) is sketched below:

(1) $GO_{it} = D_{it} + X_{it} - M_{it}$;

(2) $D_{it} = F^i(GDP_t, P_{it})$,

here it is expected that

$$\frac{\partial D_{it}}{\partial GDP_t} > 0 \text{ and } \frac{\partial D_{it}}{\partial P_{it}} < 0;$$

(3) $M_{it} = L^i(D_{it}, P_{it}, P_{mit})$,

here it is expected that

$$\frac{\partial M_{it}}{\partial D_{it}} > 0,\ \frac{\partial M_{it}}{\partial P_{it}} > 0 \text{ and } \frac{\partial M_{it}}{\partial P_{mit}} < 0.$$

The simulation exercise

Invariably the question arises how to evaluate the "goodness" of an onometric model. In the case of a single equation regression model, there is a t of statistical tests such as $\bar{R}^2$ (coefficient of goodness of fit corrected for grees of freedom), F-test, t-test, Durban-Watson statistic of serial auto-rrelation etc., that can be used to judge the statistical significance of the odel and its individual estimating equations. Even when these tests are readily ailable, however, it is no simple matter to choose one single-equation model er others, since there are other important considerations to be taken into count, such as the theoretical soundness of the model specification and the bustness of the parameter values and signs.

[2]The use of OLS may be justified in this case by the block-recursive nature of the model and e presence of measurement errors in addition to the justification of small sample size given above.

The large model has its own dynamic properties, thanks to its network c feedback mechanisms, which makes the model more powerful than any of it individual equations; so, even if all the individual equations fit the data we and are statistically significant, the result is not necessarily a reasonably clos duplication of history. Furthermore, the tracking may not be uniform for a variables and may in fact vary from variable to variable. Thus, there does no appear to be an alternative to a historical tracking of the whole model over part of the sample period. For two reasons, 1969 was chosen as a startin point. First, crude-oil production began in 1969 and subsequently accounte for the lion's share of the Syrian Government's revenues and export earnings Secondly, a marked shift in the over-all performance of the Syrian econom was observed in 1969, the economy having grown at 5.7 per cent per annun before 1969 and at 10 per cent per annum after 1969.

The dynamic simulation validated the model's tracking capability and it ability to predict turning-points. Using root mean square errors (RMSE) an Theil's inequality coefficients to quantify the discrepancy between actual an predicted values of the variables, the model is deemed to be satisfactory. Th industry model equations also proved well able to track the actual variables.

Although the macro-economic model is basically a short-run model, it i driven by exogenous investment spending. Thus, given a long-run forecast o investment, the model can be used to generate long-run forecasts of othe macro-economic variables. This approach is followed in the simulation reported below.

Several simulations were carried out to evaluate the macro-economic an industrial effects of alternative public investment decisions. Only two suc simulations will be presented here (see tables 5-10). In the first exercise investments were assumed to be exogenously set as policy instruments. I scenario I, investments in the various sectors were assumed to grow at half thei growth rate between 1963 and 1977 and their initial base values were chosen t be the high values of 1976; industrial exports were assumed to grow at thei historical rates of growth between 1963 and 1977 (or a shorter period, a available). In scenario II, the investment growth rates were assumed to fall t one third of their historical rates and the initial base values of investments o 1974 were used; exports by industrial sector were assumed to grow at 5 per cen per annum. Table 5 displays the major assumptions of both scenarios. A reference scenario (scenario III) is shown for purposes of comparison.

The growth rates of gross manufacturing output in the Syrian Ara Republic between 1980 and 2000 are 9.5 per cent per annum for the optimisti scenario (I) and 6.8 per cent for the less optimistic scenario (II). In bot scenarios, the gross output of basic metals shows the highest rates of growt (16.9 per cent per year in the optimistic scenario and 16.1 per cent in the other) The lowest rates of growth are associated with non-metallic minerals and othe manufacturing.

The forecast structure of manufacturing output is not very different fron that in existence in the 1980s. Food, beverages and tobacco, as well as textiles leather and wearing apparel, account for over 60 per cent of total manufac turing output throughout the period 1980-2000. This suggests that a seriou Syrian industrial transformation will not occur unless there is a significan departure from current trends.

Table 5. Syrian Arab Republic: parameter values for projections of sectoral gross domestic fixed investment, 1977-1990

Scenario[a]	Agriculture		Mining and manufacturing		Transport		Dwellings		Services		Total	
	g_A	I_{AO}	g_M	I_{MO}	g_T	I_{TO}	g_D	I_{DO}	g_S	I_{SO}	g	I_O
I	0.0487	187.7	0.0838	860.2	0.027	313.7	0.03985	487.2	0.0575	445.3	0.0617	2 294.1
II	0.03257	188.0	0.05597	690.0	0.018	121.0	0.0265	337.0	0.03833	225.0	0.0426	1 569.2
III	0.0974	187.7	0.1676	860.2	0.054	313.7	0.0795	487.2	0.1150	445.3	0.1285	2 294.1

Note: The parameters are the annual growth rate g_i and the initial value I_{iO}, i = A, M, T, D, S, of gross domestic fixed investment, appearing in the compound growth-rate formulas $I_i = I_{iO}(1 + g_i)^t$ and $I = I_O(1 + g)^t$, where $I = \Sigma_i I_i$. The initial values are in millions of constant (1970) Syrian pounds. For scenarios I and II, they are the actual 1976 amounts and for scenario III, the actual 1974 amounts.

[a]Scenario I is the optimistic scenario and scenario II the less optimistic one. Scenario III is used for reference only.

Table 6. Syrian Arab Republic: macro-economic impact of alternat investment programmes, 1977-2000, at 1970 constant prices

Item[a]	1975	1977	1980	1985	1990	1995	2000	Growth
	(millions of Syrian pounds)							(percent
				Manufacturing value added				
Scenario I	2 209	2 784	3 946	6 630	10 644	17 830	29 867	10.8
Scenario II		2 784	3 686	5 546	7 987	11 382	17 975	8.4
Scenario III		2 784	4 132	8 376	17 585	35 726	72 579	15.2
				Gross domestic product				
Scenario I	10 839	12 948	17 459	27 170	40 870	63 580	98 907	9.2
Scenario II		12 948	16 058	22 263	30 350	42 112	58 432	6.7
Scenario III		12 948	18 003	31 928	58 714	105 007	187 801	12.3
				General price level				
Scenario I	180.20	193	330	1 466	15 847	86 267	469 628	40.3
Scenario II		193	295	886	4 639	15 747	53 456	27.6
Scenario III		193	342	2 108	61 219	560 541	5 132 507	55.7

[a]Scenario I is the optimistic scenario and scenario II the less optimistic one. Scenario III is u for reference only.

Under scenario I, total MVA will reach 29,867 million Syrian pounds the year 2000 in terms of 1970 prices. This will account for over 30 per cent GDP, which translates into an implicit annual rate of growth of almost 10.9 cent. The low-growth scenario II, surprisingly, also results in a ratio of MVA GDP of 30 per cent. The actual value of MVA, however, is significantly bel that of the optimistic scenario, with a value of LS 17,974 million in 1970 pric The present sectoral allocation of investment favours the manufacturing sec and this pattern is likely to continue in the future. The above results reflect t emphasis on the manufacturing sector.

Using the ratio of value added to gross output as a proxy for the degree local processing within the economy, it seems that only a few sectors will sh modest increases in this ratio. Textiles, chemicals, non-metallic minerals a fabricated metals are among these sectors. It is interesting to note that elasticity of value added with respect to GDP is highest in the non-meta mineral products sector, which is forecast to grow the least. Thus, the degree local processing (ratio of MVA to GDP) could be increased more rapidly investment were shifted to this sector.

The structure of manufacturing imports is expected to show some mi changes between 1980 and 2000. Surprisingly, imports of food, beverages a tobacco will increase their share in total imports from 20.3 per cent in 1980 22.6 per cent in 2000. The share of textile imports is expected to fall, tho not substantially, from 4.1 per cent in 1980 to 3.8 per cent in 2000. The m significant decline is in the share of imports of chemical and petrole products, which are likely to fall from 8.4 per cent in 1980 to 5.5 per cen 2000.

Imports of manufactured products, given the present structures and assumptions that have been made about the behaviour of exogenous variab

Table 7. Syrian Arab Republic: projections of local demand, 1980-2000, at 1970 constant prices

(Millions of Syrian pounds)

	Scenario I[a]					Scenario II[b]				
Manufacturing activity	*1980*	*1985*	*1990*	*1995*	*2000*	*1980*	*1985*	*1990*	*1995*	*2000*
Food, beverages and tobacco	4 566	7 496	11 754	19 016	30 478	4 100	5 862	8 251	11 866	16 997
Textile, wearing apparel and leather industries	2 253	3 405	5 049	7 806	12 121	2 080	2 799	3 750	5 156	7 124
Wood and wood products, including furniture	403	650	1 617	2 578	2 578	364	513	715	715	1 450
Paper, paper products, printing and publishing	180	292	456	737	1 181	134	228	319	319	656
Chemicals and chemical, petroleum, coal, rubber and plastic products	1 607	2 468	3 706	5 794	9 073	1 475	2 005	2 712	3 767	5 252
Non-metallic mineral products, except products of petroleum and coal	430	666	996	1 538	2 376	397	551	748	1 032	1 424
Basic metal industries	3 087	5 480	8 951	14 860	24 182	2 708	4 152	6 105	9 053	13 233
Fabricated metal products, machinery and equipment	3 316	5 520	8 650	13 868	22 013	2 991	4 382	6 210	8 890	12 627
Other manufacturing industries	57	93	141	218	337	52	77	106	146	202
Total manufacturing	15 901	26 071	40 712	65 454	104 340	14 301	20 570	28 918	41 387	58 965

[a]Optimistic.

[b]Less optimistic.

Table 8. Syrian Arab Republic: projections of imports, 1980-2000, at 1970 constant prices

(Millions of Syrian pounds)

	Scenario I[a]					Scenario II[b]				
Manufacturing activity	*1980*	*1985*	*1990*	*1995*	*2000*	*1980*	*1985*	*1990*	*1995*	*2000*
Food, beverages and tobacco	1 804	3 145	5 115	8 509	13 893	1 583	2 370	3 454	5 120	7 504
Textile, wearing apparel and leather industries	368	597	926	1 481	2 352	333	474	663	943	1 338
Wood and wood products, including furniture	74	109	158	240	368	69	91	121	163	222
Paper, paper products, printing and publishing	76	116	176	279	442	59	93	125	175	248
Chemicals and chemical, petroleum, coal, rubber and plastic products	743	1 064	1 509	2 237	3 361	699	910	1 179	1 564	2 092
Non-metallic mineral products, except products of petroleum and coal	240	402	628	999	1 574	217	322	458	652	921
Basic metal industries	2 963	5 280	8 646	14 387	21 338	2 594	3 987	5 875	8 733	12 199
Fabricated metal products, machinery and equipment	2 559	4 315	6 834	11 075	17 727	2 291	3 377	4 823	6 972	9 991
Other manufacturing industries	50	85	130	206	323	45	68	95	134	188
Total manufacturing	8 877	15 122	24 122	39 412	61 379	7 891	11 693	16 793	24 456	34 703

Source: Based on linear regression.

[a]Optimistic.

[b]Less optimistic.

Manufacturing activity	Scenario I[a] 1980	1985	1990	1995	2000	Scenario II[b] 1980	1985	1990	1995	2000
	(Millions of Syrian pounds)									
Food, beverages and tobacco	2 842	4 480	6 847	10 841	17 122	2 586	3 587	4 910	6 891	9 678
Textile, wearing apparel and leather industries	2 070	3 104	4 601	7 094	11 008	1 908	2 529	3 349	4 545	6 210
Wood and wood products, including furniture	333	547	859	1 235	2 235	298	426	599	863	1 237
Paper, paper products, printing and publishing	107	180	287	469	757	77	138	198	287	414
Chemicals and chemical, petroleum, coal, rubber and plastic products	870	1 414	2 212	3 582	5 753	781	1 102	1 542	2 214	3 175
Non-metallic mineral products, except products of petroleum and coal	211	258	422	625	942	198	251	320	418	551
Basic metal industries	124	200	306	473	2 844	144	165	231	320	1 034
Fabricated metal products, machinery and equipment	799	1 272	1 923	2 967	4 565	736	1 051	1 446	1 993	2 733
Other manufacturing industries	9	11	15	19	25	8	11	13	15	18
Total manufacturing	7 364	11 507	17 472	27 464	45 251	6 707	9 255	12 607	17 547	25 050
	(Percentage share)									
Food, beverages and tobacco	38.6	38.9	39.2	39.5	37.8	38.6	38.7	38.9	39.3	38.6
Textile, wearing apparel and leather industries	28.1	27.0	26.3	25.8	24.3	28.4	27.3	26.6	25.9	24.8
Wood and wood products, including furniture	4.5	4.8	4.9	5.1	4.9	4.4	4.6	4.8	4.9	4.9
Paper, paper products, printing and publishing	1.4	1.6	1.6	1.7	1.7	1.1	1.5	1.6	1.6	1.7
Chemicals and chemical, petroleum, coal, rubber and plastic products	11.8	12.3	12.7	13.0	12.7	11.6	11.9	12.2	12.6	12.7
Non-metallic mineral products, except products of petroleum and coal	2.9	2.6	2.4	2.3	2.1	2.9	2.7	2.5	2.4	2.2
Basic metal industries	1.7	1.7	1.8	1.7	6.3	1.7	1.8	1.8	1.8	4.1
Fabricated metal products, machinery and equipment	10.8	11.1	11.0	10.8	10.1	11.0	11.4	11.5	11.4	10.9
Other manufacturing industries	0.1	0.1	0.1	0.07	0.06	0.1	0.1	0.1	0.1	0.1
Total manufacturing	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Optimistic.

[b]Less optimistic.

Table 10. Syrian Arab Republic: relationship of manufacturing valı added to gross output, 1963-1977

(Logarithmic specifications)

Manufacturing activity	Coefficient[a] Intercept	Gross output	$\bar{R}^2$	D.
Food, beverages and tobacco	3.18 (3.3)	0.675 (9.5)	0.87	0.
Textile, wearing apparel and leather industries	−1.96 (1.13)	1.06 (8.5)	0.85	2.
Wood and wood products, including furniture	−0.6061 (0.78)	0.964 (14.4)	0.94	0.
Paper, paper products, printing and publishing	−0.2613 (0.55)	0.924 (20.2)	0.97	1.
Chemicals and chemical, petroleum, coal, rubber and plastic products	−3.357 (1.9)	1.161 (8.3)	0.86	0.
Non-metallic mineral products, except products of petroleum and coal	−2.208 (4.8)	1.16 (28.7)	0.98	2.
Basic metal industries	−0.48 (0.94)	0.971 (20.0)	0.97	1.
Fabricated metal products, machinery and equipment	−1.32 (5.6)	1.05 (53.5)	0.99	1.
Other manufacturing industries	1.03 (0.65)	0.813 (4.8)	0.63	0.

[a]The numbers in parentheses are *t* values.

are likely to rise to unacceptable magnitudes. Furthermore, the impo coefficients (imports as percentages of gross output) indicate that impo substitution is not likely in several sectors. Total gross output in manufacturi is projected in this model, under both scenarios, to grow less rapidly tha imports.

The above conclusions are based on a continuation of historical trends the industrial sectors. The rather unencouraging forecasts suggest that Syria planners may attempt to alter these trends.

The model presented here can provide a useful framework to test tl workability of alternative policies. It is also possible to use the model generate numerical forecasts of the responsiveness of the various variables other (macro-economic) policy instruments.

Concluding remarks

An integrated system of a macro-economic model and a detailed indust model were used to generate consistent projections of the structure of output the manufacturing sector in the Syrian Arab Republic. The picture that h emerged is one of limited structural transformation within the manufacturi sector. The projected growth of demand suggests, however, that there is significant industrial potential in Syria. On the basis of historical trend

ports are shown to satisfy an increasing proportion of demand, thus warting domestic industrial development.

The forecasts are conditional on long-term forecasts of sectoral invest-ents and should be interpreted accordingly.

The model may also be used to simulate alternative investment policies d trace their impact on future structures.

Annex

SPECIFICATION AND ESTIMATION OF THE MODEL

In the following list of equations, the subscripts referring to sectors are as follows:

A agriculture
D dwellings
G government
M mining and manufacturing
P private
S services and others
T transport

e other symbols are identified in the appendix. Unless otherwise noted, variables asured in monetary units are in millions of Syrian pounds. When marked with an erisk they are in terms of current prices; otherwise, in terms of constant (1970) prices. bour market and employment variables are measured in thousands.

Equations are for year t; the subscript -1 refers to year $t-1$.

Numbers in parentheses under the coefficients are the t-values for the statistical imates of the coefficients.

Production and expenditures

lue added

$$\mathrm{GDP} = Y_A + Y_M + Y_T + Y_D + Y_S$$

$$Y_A = \underset{(2.467)}{644.823} + \underset{(5.687)}{0.3847} \sum_{i=1}^{t-1} I_{Ai} + \underset{(2.798)}{4.0826}\, \mathrm{IR}$$

$\bar{R}^2 = 0.70$, D.W. = 1.96, 1964-1977

$$Y_M = \underset{(4.242)}{556.283} + \underset{(11.523)}{0.352} \sum_{i=1}^{t-1} I_{Mi} + \underset{(1.375)}{2.9}\, M_{R-1}$$

$\bar{R}^2 = 0.97$, D.W. = 1.68, 1964-1977

$$Y_T = 292.05 + \underset{(5.70)}{0.279} \sum_{i=1}^{t-1} I_{Ti} + \underset{(3.619)}{0.898}\, M_{T-1}$$

$\bar{R}^2 = 0.76$, D.W. = 1.67, 1964-1977

$$Y_D = 404.958 + 0.068 \sum_{i=1}^{t-1} I_{Di}$$
$$(90.129)(30.363)$$
$$\bar{R}^2 = 0.99, \text{ D.W.} = 0.46, \text{ 1964-1977}$$

$$Y_S = -540.386 + 0.39 \sum_{i=1}^{t-1} I_{Si} + 0.448 \text{ GDP}$$
$$(-2.089)(1.717) \qquad (7.0)$$

$$\bar{R}^2 = 0.99, \text{ D.W.} = 1.50, \text{ 1964-1977}$$

Gross domestic fixed investment

$$I = \Sigma I_i, \; i = \text{A, M, T, D, S, G, P}$$

$$I = 360.142 + 0.276 \; (\text{GDP} - \text{GDP}_{-1}) + 2.199 \; M_{K-1} + 744.096 \text{ DV},$$
$$(2.06) \; (1.837) \qquad (3.404) \qquad (2.391)$$
$$\text{DV} = 1 \text{ for 1975-1977}$$

$$\bar{R}^2 = 0.90, \text{ D.W.} = 2.67, \text{ 1963-1977}$$

$$I_A = I_{A-1}(1 + g_A)$$
$$I_A = \pi_A I$$

$$I_M = I_{M-1}(1 + g_M)$$
$$I_M = \pi_M I$$

$$I_T = I_{T-1}(1 + g_T)$$
$$I_T = \pi_T I$$

$$I_D = I_{D-1}(1 + g_D)$$
$$I_D = \pi_D I$$

$$I_S = I_{S-1}(1 + g_S)$$
$$I_S = \pi_S I$$

$$I_G = -56.322 + 0.6298 \, I + 162.842 \text{ DV}, \text{ DV} = 1 \text{ for 1974-1977}$$
$$(-0.884) \; (10.073) \qquad (1.487)$$
$$\bar{R}^2 = 0.97, \text{ D.W.} = 1.31, \text{ 1963-1977}$$

$$I_P = I - I_G$$

Consumption

$$C = \text{GDP} - I + M - X$$

$$C_G = -540.778 + 0.24 \text{ GDP} + 0.198 \; C_{G-1}$$
$$(-2.13) \; (2.34) \qquad (0.52)$$
$$\bar{R}^2 = 0.98, \text{ D.W.} = 1.45, \text{ 1961-1977}$$

$$C_P = C - C_G$$

$$C_F = 706.085 - 2370.44 \, (p_{DF}/p) + 0.9642 \; Y_A + 1.949 \text{ GDPPC}$$
$$(0.754) \quad (-2.25) \qquad (2.91) \qquad (3.76)$$
$$\bar{R}^2 = 0.96, \text{ D.W.} = 2.66, \text{ 1963-1977}$$

vernment revenue

$$R_G = \underset{(2.82)}{549.48} + \underset{(0.925)}{0.0298}\,(\mathrm{GDP} + M) + \underset{(6.08)}{765.3}\,\mathrm{DV}_1 + \underset{(6.18)}{1912.88}\,\mathrm{DV}_2,$$

$\mathrm{DV}_1 = 1$ for 1968-1973, $\mathrm{DV}_2 = 1$ for 1974-1977

$\bar{R}^2 = 0.95$, D.W. = 2.41, 1960-1977

vernment deficit

$$\mathrm{GD} = R_G - C_G - I_G$$

$$\mathrm{GD}^* = p \cdot \mathrm{GD}$$

Money market and prices

ney base

$$\mathrm{MB}^* = \underset{(9.93)}{784.9426} + \underset{(26.96)}{0.6146} \sum_{i=1}^{t-1} \mathrm{GD}_i^*$$

$\bar{R}^2 = 0.98$, D.W. = 2.28, 1964-1976

ney supply

$$\mathrm{MYS}^* = \underset{(-2.62)}{-311.153} + \underset{(37.7)}{1.52}\,\mathrm{MB}^*$$

$\bar{R}^2 = 0.99$, D.W. = 1.41, 1960-1977

gregate demand for money

$$\mathrm{MYD}^* = \underset{(-14.92)}{-5128.43} + \underset{(2.1)}{0.2708}\,\mathrm{GDP} + \underset{(6.06)}{54.92}\,p$$

$\bar{R}^2 = 0.98$, D.W. = 1.36, 1960-1977

P price deflator

$$p = \underset{(8.35)}{62.638} + \underset{(3.85)}{0.0081}\,\mathrm{MYS}^* - \underset{(-0.916)}{0.00166}\,\mathrm{GDP} + \underset{(3.56)}{0.3016}\,p_M$$

$\bar{R}^2 = 0.99$, D.W. = 1.55, 1960-1977

mestic food price index

$$p_{\mathrm{DF}} = \underset{(-2.11)}{-9.673} + \underset{(3.61)}{0.10}\,p_{\mathrm{DMF}} + \underset{(16.49)}{1.03}\,p_{\mathrm{DF}-1}$$

$\bar{R}^2 = 0.99$, D.W. = 2.76, 1964-1977

Labour market and employment

Aggregate demand for labour

$$\text{Ln}\,(L/\text{GDP}) = -1.3568 - 0.063\,t$$
$$(-33.67) \qquad (8.8)$$
$$\bar{R}^2 = 0.91,\ \text{D.W.} = 1.70,\ 1969\text{-}1977$$

$$L = 0.25748\ \text{GDP}\cdot\exp\,(-0.063\,t)\ (1975\text{-}1977)$$
$$L = 0.2553\ \text{GDP}\cdot\exp\,(-0.0596\,t)\ (1969\text{-}1974)$$

Demand for labour in mining and manufacturing

$$\text{Ln}\,(L_M/Y_M) = -1.4488 - 0.068\,t - 0.0316\ \text{DV},\ \text{DV} = 1 \text{ for } 1971$$
$$(-29.5) \quad (-10.2) \quad (-0.38)$$
$$\bar{R}^2 = 0.90,\ \text{D.W.} = 1.03,\ 1964\text{-}1975$$

$$L_M = 0.2348\ Y_M\cdot\exp\,(0.0681\,t - 0.0316\ \text{DV})$$

Demand for labour in transport

$$\text{Ln}\,(L_T/Y_T) = -2.067 - 0.049\,t - 0.4166\ \text{DV},\ \text{DV} = 1 \text{ for } 1971$$
$$(33.87) \quad (-5.87) \quad (-3.99)$$
$$\bar{R}^2 = 0.83,\ \text{D.W.} = 1.93,\ 1964\text{-}1975$$

$$L_T = 0.1264\ Y_T\cdot\exp\,(-0.049\,t - 0.4166\ \text{DV})$$

Demand for labour in services and others

$$\text{Ln}\,(L_S/Y_S) = -1.422 - 0.056\,t - 0.1249\ \text{DV},\ \text{DV} = 1 \text{ for } 1971$$
$$(-30.45) \quad (-8.83) \quad (-1.56)$$
$$\bar{R}^2 = 0.88,\ \text{D.W.} = 1.11,\ 1964\text{-}1975$$

$$L_S = 0.241\ Y_S\cdot\exp\,(-0.0564\,t - 0.1249\ \text{DV})$$

Demand for labour in agriculture

$$L_A = L - L_M - L_T - L_S$$

Aggregate supply of labour

$$\text{Ln}\,N = 7.027 + 0.0304\,t$$
$$(762.769) \quad (35.709)$$
$$\bar{R}^2 = 0.99,\ \text{D.W.} = 1.63,\ 1960\text{-}1977$$

$$N = 1126.646\ \exp\,(0.0304\,t)\ (1960\text{-}1968)$$
$$N = 1494.73\ \exp\,(0.02835\,t)\ (1969\text{-}1976)$$

employment

$$U = N - L$$

employment rate

$$u' = (N - L)/N$$

Foreign trade

ports of capital goods

$$M_K = -67.138 + 0.394\, I - 0.491\, M_{K-1}$$
$$(11.246) \quad (-4.085)$$
$$\bar{R}^2 = 0.95,\ \text{D.W.} = 1.99,\ 1964\text{-}1976$$

ports of raw materials

$$M_R = 38.585 + 0.0299\, Y_M + 36.4337\ \text{DV},\ \text{DV} = 1 \text{ for } 1974$$
$$(6.7) \quad (7.15) \quad (4.1)$$
$$\bar{R}^2 = 0.89,\ \text{D.W.} = 1.86,\ 1963\text{-}1976$$

ports of foodstuffs

$$M_{FS} = 60.2 + 0.0297\ \text{GDP} + 162.47\ \text{DV},\ \text{DV} = 1 \text{ for } 1970 \text{ and } 1971$$
$$(1.474) \quad (5.94) \quad (4.49)$$
$$\bar{R}^2 = 0.78,\ \text{D.W.} = 2.26,\ 1964\text{-}1977$$

el imports

$$M_{FL} = -226.89 + 0.06791\ \text{GDP} - 1.75681\, Q_{CO-1}$$
$$(-5.42) \quad (8.37) \quad (-6.24)$$
$$\bar{R}^2 = 0.92,\ \text{D.W.} = 1.92,\ 1969\text{-}1976$$

tal imports of goods

$$M_G = M_K + M_R + M_{FS} + M_{FL} + M_O$$

tal imports

$$M = M_G + M_{NFS}$$

ude oil exports

$$X_{CO} = -3.7823 + 1.214\, Q_{CO} + 65.247\ \text{DV},\ \text{DV} = 1 \text{ for } 1974\text{-}1976$$
$$(-0.267) \quad (9.28) \quad (3.63)$$
$$\bar{R}^2 = 0.98,\ \text{D.W.} = 2.19,\ 1968\text{-}1976$$

Exports of textiles

$$X_{TX} = -33.086 + 1.0107\, Q_{TX} + 61.55\ \mathrm{DV},\ \mathrm{DV} = 1 \text{ for } 1973$$
$$\quad (-1.42) \quad (4.68) \quad (4.68)$$
$$\bar{R}^2 = 0.79,\ \mathrm{D.W.} = 1.59,\ 1963\text{-}1976$$

Exports of goods

$$X_G = X_{CO} + X_{CN} + X_{TX} + X_O$$

Total non-factor service receipts

$$X_{TNFS} = X_{NFS} + \mathrm{OTD}$$

Total exports

$$X = X_G + X_{TNFS}$$

Exports at current prices

$$X_i^* = X_i \cdot p_{X_i},\ i = \mathrm{CO, CN, TX, O, TNFS}$$

Total exports at current prices

$$X^* = X^*_{CO} + X^*_{CN} + X^*_{TX} + X^*_O + X^*_{TNFS}$$

Imports at current prices

$$M_i^* = M_i \cdot p_{M_i},\ i = \mathrm{K, R, FL, FS, O, NFS}$$

Total imports at current prices

$$M^* = M^*_K + M^*_R + M^*_{FS} + M^*_{FL} + M^*_O + M^*_{NFS}$$

Resource gap at current prices

$$\mathrm{T}^*_G = M^* - X^*$$

Resource gap at constant prices

$$\mathrm{TG} = M - X$$

Commodity trade gap at constant prices

$$\mathrm{CTG} = M_G - X_G$$

Commodity trade gap at current prices

$$\mathrm{CTG}^* = M^*_G - X^*_G$$

rms of trade adjustment

$$\mathrm{TTADJ} = (X^*/p_M) - (X^*/p_X)$$

ports adjusted

$$X_{\mathrm{adj}} = X + \mathrm{TTADJ}$$

Balance of payments

rrent-account balance

$$\mathrm{CAB}^* = X^* - M^* + \mathrm{NFY}^* + \mathrm{NT}^*$$

pital-account balance

$$\mathrm{KAB}^* = \mathrm{NPC}^* + \mathrm{GFB}^* - \mathrm{AMGFD}^*$$

blic foreign borrowing

$$\underset{}{\mathrm{GFB}^*} = \underset{(4.747)}{163.402} + \underset{(3.27)}{0.1078\,\mathrm{GD}^*} + \underset{(8.29)}{915.628\ \mathrm{DV}}, \ \mathrm{DV} = 1 \text{ for } 1976\text{-}1977$$

$\bar{R}^2 = 0.98$, D.W. = 2.11, 1966-1977

ortization on public foreign debt

$$\mathrm{AMGFD}^* = \underset{(-4.72)}{-170.166} + \underset{(9.32)}{0.206\ \mathrm{GFD}^*_{-1}}$$

$\bar{R}^2 = 0.92$, D.W. = 2.1, 1969-1976

blic foreign debt

$$\mathrm{GFD}^* = \mathrm{GFD}^*_{-1} + \mathrm{GFB}^* - \mathrm{AMGFD}^*$$

erest on public foreign debt

$$\mathrm{INTGFD}^* = \underset{(-2.17)}{-37.989} + \underset{(3.5)}{0.0375\ \mathrm{GFD}^*_{-1}}$$

$\bar{R}^2 = 0.62$, D.W. = 1.2, 1969-1976

icial debt service ratio

$$\mathrm{GDSR}^* = (\mathrm{AMGFD}^* + \mathrm{INTGFD}^*)/X^*$$

ange in reserves

$$\triangle\mathrm{RV}^* = \mathrm{CAB}^* + \mathrm{KAB}^* + \mathrm{KADJ}^*$$

erves

$$\mathrm{RV}^* = \mathrm{RV}^*_{-1} + \triangle\mathrm{RV}^*$$

Other identities

Gross domestic income

$$GDY = GDP + TTADJ$$

Gross national product

$$GNP = GDP + NFY$$

GDP per capita

$$GDPPC \text{ (in Syrian pounds)} = GDP/TP \text{ (in millions)}$$

Gross domestic saving

$$DS = GDP - C$$

Gross national saving

$$NS = DS + NFY + NT$$

Domestic investment saving gap

$$DISG = I - DS$$

Appendix

IDENTIFICATION OF SYMBOLS

Variables

AMGFD	amortization on public foreign debt
C	total consumption
C_F	food consumption
C_G	government consumption
C_P	private consumption
CAB	current-account balance
CTG	commodity trade gap
DISG	domestic investment saving gap
DS	domestic saving
DV	dummy variable
D.W.	Durbin-Watson statistic
GD	government deficit
GDP	gross domestic product
GDPPC	GDP *per capita*
GDSR	official debt service ratio
GDY	gross domestic income

B public foreign borrowing
D public foreign debt
P gross national product
aggregate gross domestic fixed investment
sectoral gross domestic fixed investment; i = A, D, G, M, P, S, T
GFD interest on public foreign debt
index of average rainfalls (exogenous)
B capital-account balance
DJ capital adjustment (exogenous)
aggregate demand for labour
sectoral demand for labour; i = A, M, S, T
total imports
imports of type i; i = FL (fuel), FS (foodstuffs), G (total goods), K (capital goods), NFS (non-factor services), O (other), R (raw materials), T (transport); M_{NFS} and M_O are exogenous
monetary base
D aggregate demand for money
S aggregate supply of money
aggregate supply of labour
Y net factor income (exogenous)
C net private capital flow (exogenous)
national saving
net transfers from abroad (exogenous)
D oil transit dues (exogenous)
GDP price deflator
domestic food price index
MF domestic food imports price index (exogenous)
import price index (exogenous)
price index of import i (exogenous); see M_i above
export price index (exogenous)
price index of export i; see X_i below
O production index of crude oil (exogenous)
X production index of textiles (exogenous)
coefficient of determination (adjusted for degrees of freedom)
government revenue
reserves
resource gap
total population
ADJ terms of trade adjustment
unemployment
unemployment rate
total exports
j total exports, adjusted
exports of type i; i = CN (cotton), CO (crude oil), G (goods), NFS (non-factor services minus oil transit dues), O (other), TNFS (total non-factor services), TX (textiles); X_{CN}, X_{NFS}, X_O, and X_{TNFS} are exogenous.
value added
sectoral value added; i = A, M, T, D, S

Exogenous parameters

investment growth rate of sector i; i = A, D, G, M, P, S, T
share of sector i in investment

ɔoks

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